Small Unmanned Aircraft System Rulemaking Committee (Federal)

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Small Unmanned Aircraft System Aviation Rulemaking Committee

Comprehensive Set of Recommendations for sUAS Regulatory Development

April 1, 2009

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Unless flagged with a solid dot (●), the material contained in this document represents general consensus of the members of the Small Unmanned Aircraft System (sUAS) Aviation Rule-making Committee. When there is less than general consensus, alternative views are included along with their accompanying rationale.

Forward

The Small Unmanned Aircraft System (sUAS) Aviation Rulemaking Committee (ARC) was focused on making recommendations for Federal regulations for the operation of civil (commercial) sUAS. However it was understood by the members of the ARC that a public entity could fly under the provisions of any rule that might result from these recommendations in lieu of flying under the provisions of a Certificate of Authorization (COA) or in restricted, prohibited, or warning areas. In formulating the recommendations contained in this document, sUAS ARC used the following guiding principles:

1. Enable the operation of sUAS by mitigating, to an acceptable level of risk, the hazards posed to manned aircraft and other airborne objects operating in the National Airspace System (NAS) as well as the public on the surface.
2. The development of regulations authorizing specific operations of certain sUAS could provide a means for operators to request a waiver(s) from such a rule. Such an option is not available to operators today.
3. Visual "see and avoidance" will be used by the sUAS flight crew to mitigate the risk of collision with other aircraft and airborne objects.
4. The primary burden of maneuvering for potential collision risk avoidance should be on the sUAS flight crew.
5. All other aircraft have the right-of-way over sUAS.
6. The above two principles do not relieve burden upon any pilot to see and avoid other aircraft.
7. Operating limitations will be defined to reduce or minimize potential encounters between manned and unmanned aircraft and reduce vulnerability of those on the surface.
8. A formal Federal Aviation Administration (FAA) safety risk assessment will be used to determine whether proposed regulations are acceptable to the FAA from a safety perspective. If a specific recommendation is not acceptable from a safety perspective then the FAA may require additional mitigations and/or controls.
9. Mitigations and controls should be tied to the level of risk to avoid being overly burdensome on the application of sUAS technology. If a specific recommendation is overly excessive or burdensome then the FAA may elect to modify the recommendation in developing proposed regulations.
10. The recommended regulations should not be overly complex to facilitate analysis by the FAA and other stakeholders.
11. Recommendations will leverage existing standards and regulations which govern the operation of small unmanned and Model Aircraft.
12. Where feasible, the ARC will use existing definitions and regulations to develop recommendations.

13. sUAS ARC recommendations for an Special Federal Airworthiness Regulation (sFAR):
    - Are intended to enable some initial sUAS operations
    - Are not intended to cover all potential applications or aircraft
        - Existing processes such as COAs for public-use aircraft and Special Airworthiness Certificate will remain options.
        - Recommendations are directed at sUAS not necessarily all unmanned aircraft systems.

Overall the committee was focused on a layered approach to ensuring that the potential risks associated with mid-air collisions and/or injury to persons and property is within acceptable levels. Many of the committee's recommendations were made based upon experience with existing aviation operations and regulations and perceptions of risk. Overall, the committee was equally focused on protecting existing air traffic and persons/property on the surface. In general, the philosophy was to minimize encounters, keep sUAS separated from other aircraft and surface risks, avoid collisions, and minimize the impact of collisions that may happen. See Figure 1.

The committee perceives that the recommendations in this document combine together to enable sUAS operations at an acceptable level of risk. As more experience with sUAS is gained and more data generated, these recommendations should be revisited.

For the most part, the committee's recommendations are written in a language like proposed regulations. Rationale and commentary which explain the recommended regulations are imbedded throughout the document and appear inside boxes in italic text. Unless flagged with a solid dot (●), the material contained in this document represents general consensus of the members of the sUAS ARC. When there was less than general consensus, alternative views are included inside boxes in italic text along with their accompanying rationale.

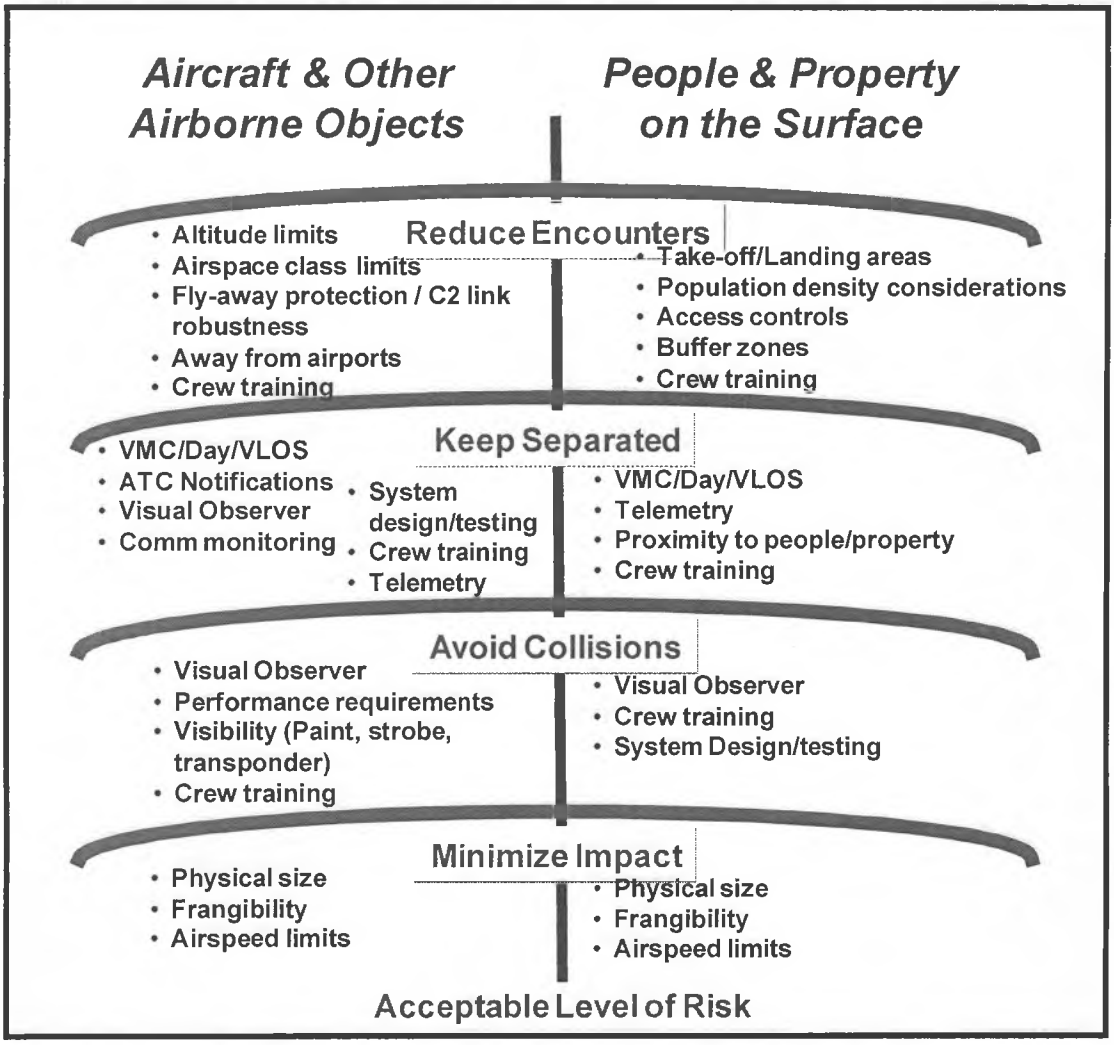

Figure 1. Layered Approach for Ensuring Safety

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1. Definitions

The following definitions apply to all small unmanned aircraft systems (sUAS) referred to in this regulation.

Auto Flight Management: Pilot-in-Command (PIC) is able to maintain stable flight without constant direct intervention. To at least some degree, control surface movements result from sensors and software automation on-board the aircraft.

Collision Avoidance: Considered a last resort maneuver of an aircraft to avoid an imminent collision. Without the maneuver a collision might occur.

Conflict Avoidance: Activity which seeks to ensure that aircraft remain safely separated and well clear of each other as to not present a collision hazard.

Control Station: Equipment, not on the aircraft, used to maintain control, communicate, guide, or otherwise operate an unmanned aircraft.

Data Communications Links: All links between the unmanned aircraft and the Control Station which includes the command, status, communications, and payload links.

Launch/Recovery Equipment: Equipment, not on-board the aircraft, used to launch and recover an unmanned aircraft which could also include unique navigation and differential positioning equipment used for autonomous landing.

Model Aircraft: A sUAS used by hobbyists and flown within visual line-of-sight under direct control from the pilot, which can navigate the airspace, and which is manufactured or assembled, and operated for the purposes of sport, recreation and/or competition.

"Mode C Veil": The airspace within 30 nautical miles (NM) of an airport listed in Appendix D, Section 1 of 14 Code of Federal Regulations (CFR) Part 91 (generally primary airports within Class B airspace areas), from the surface upward to 10,000 feet mean sea level (MSL). Unless otherwise authorized by Air Traffic Control (ATC), aircraft operating within this airspace must be equipped with automatic pressure altitude reporting equipment having Mode C capability. However, an aircraft that was not originally certificated with an engine-driven electrical system or which has not subsequently been certified with a system installed may conduct operations within a Mode C veil provided the aircraft remains outside Class A, B, or C airspace; and below the altitude of the ceiling of a Class B or Class C airspace area designated for an airport or 10,000 feet MSL, whichever is lower. [Directly quoted from the Federal Aviation Administration's (FAA's) Aeronautical Information Manual: Official Guide to Basic Flight Information and ATC Procedures, February 14, 2008].

Pilot-in-Command: Same as 14 CFR 1.1

Manual Flight Control: PIC is able to directly control the aircraft such that control inputs made at the Control Station are translated directly into corresponding control surface positions. Augmentations which help maintain flight stability are permitted.

sUAS Flight Crewmember: A pilot, visual observer, payload operator or other person assigned duties for a sUAS for the purpose of flight.

sUAS Pilot: A person exercising control over an unmanned aircraft during flight.

Unmanned Aircraft: An aircraft (as defined by 14 CFR 1.1) that is intended to navigate in the air without an onboard pilot.

Unmanned Aircraft System (UAS): An unmanned aircraft and its associated elements related to flight operation which may include Control Stations, data communications links, support equipment, payloads, flight termination systems, and launch/recovery equipment.

Visual Line-of-Sight: Unaided (corrective lenses and/or sunglasses exempted) visual contact with aircraft sufficient to be able to maintain operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to decisively see and avoid other air traffic or objects.

Visual Observer: A sUAS flight crew member who assists the sUAS PIC in the duties associated with collision avoidance. This includes, but is not limited to, avoidance of other traffic, airborne objects, clouds, obstructions, and terrain.

Subpart A. Model Aircraft

2. Model Aircraft Operated in Accordance with FAA Accepted Standards

2.1 Applicability

Model Aircraft operations that are conducted in accordance with an FAA accepted set of standards established and administered by a community based association as discussed in Section 2.2, shall otherwise be exempt from the requirements of any Special Federal Airworthiness Regulation (SFAR) that results from this recommendation as long as they are operated by:

- Hobbyist for the sole purpose of sport, recreation and/or competition under the conditions of such an FAA accepted program
- Manufacturers which are flight testing aircraft intended to be operated for the sole purpose of sport, recreation, and/or competition and they are tested at an approved field as defined by and in accordance with an FAA accepted program with the approval of the community-based association responsible for the location
- Educational institutions and/or students for the sole purpose of education or research and they are operated at an approved field as defined by and in accordance with an FAA accepted program with the approval of the community-based association responsible for the location
- Manufacturers which are flight testing aircraft intended to be operated for other than sport, recreation, and/or competition and they are tested at an approved field as defined by and in accordance with an FAA accepted program with the approval of the community-based association responsible for the location

> ***RATIONALE:*** *Reflects FAA's concept of regulating model aviation by exempting Model Aircraft from regulation. Under this approach, modelers participating within an aeromodeling structure/organization such as the Academy of Model Aeronautics (AMA) may operate their Model Aircraft in accordance with an accepted set of standards and operating procedures. Based on a more rigorous attention to safety, risk assessment, and risk mitigation, the accepted standards may provide greater latitude in the Model Aircraft operations. Modelers not participating in the additional safety programming established in an accepted set of standards shall comply with the requirements of Section 3.*

COMMENTARY: *It is important that manufacturers of Model Aircraft are able to test fly their aircraft as they do today without having to adhere to sUAS regulations. In order to give educational institutions (e.g., universities) the flexibility to provide "hands on" instruction and training to students preparing for careers in the UAS and aviation industries they are allowed to fly these systems under the requirements for Model Aircraft. For consistency, manufacturers who develop sUAS that are functionally similar to Model Aircraft, are allowed to test at a location following a community-based and FAA-accepted program.*

2.2 Accepted Model Aircraft Standards and Procedures

Accepted Model Aircraft Standards and Procedures may be established and administered by a community-based association. An accepted set of standards shall be based upon accepted and recognized safety principles and will include but not be limited to the following:

RATIONALE: *Community based organizations, such as the AMA, that have credibility within the Model Aircraft community and that have an established safety record and have demonstrated the ability to influence participant compliance shall be afforded the opportunity to establish a set of safety standards that are more comprehensive than the requirements and limitations given for non participating modelers, and use these standards as an alternative means of compliance with any regulations which may results from these recommendations. Since such standards are more comprehensive, operations under such standards shall allow for a broad spectrum of operations and greater latitude in the AMA operations.*

(1) Prescribed safety program entailing oversight, assessment, risk mitigation, and accident/incident reporting.

(2) General safety guidelines and operating principles.

(3) Operating guidelines specific to the location and to the type, size, performance, and propulsion of the various Model Aircraft.

(4) Comprehensive programming addressing Model Aircraft having non standard weight, or identified as having unusual propulsion types or extraordinary flight characteristics.

(5) Programming to facilitate Model Aircraft events, competition, national and international record attempts, gatherings, and Model Aircraft demonstrations and exhibitions.

(6) Educational programming that assures participants are provided relevant safety information and validates the learning process.

(7) Educational programming that addresses essential piloting issues including:

- Recognition and avoidance of manned aircraft
- Safe operation near spectators and other non participants

- Safe and cooperative operation with other modelers
- Transitioning to higher performance and more complex models

(8) Methodology for establishing and designating dedicated Model Aircraft flying sites providing:

- Guidelines for flying site location, configuration and design layout applicable to its intended use and the type(s) of Model Aircraft flown, and which ensures Model Aircraft operations do not interfere with manned flight operations
- Safety guidelines that ensure the safety of the public and provide adequate separation of persons and property from the Model Aircraft operations
- Guidelines for coordinating and reviewing operating policies and procedures with the airspace controlling authority for those flying sites located within controlled airspace
- Guidelines for coordinating and reviewing operating policies and procedures with the airport and applicable airspace control authority for those flying sites located within 3 NM of a military or public-use airport, heliport, or seaplane base.
- Guidelines for establishing and disseminating flying site operating procedures, limitations and safety guidelines including the following:
  - Hours of Operation
  - Flying site operating procedures
  - Frequency control procedures (if applicable)
  - Traffic pattern and flight operations
  - Cooperation with other modelers
  - Applicable altitude restrictions
  - Applicable No-Fly zones and operating area limits
  - Flight line and pit area safety procedures
  - Spectator and public access policies
  - Emergency Procedures (e.g., Fire, First Aid)

3. Model Aircraft Not Operated in Accordance with Accepted Set of Standards ●

3.1 Applicability ●

The following general requirements and limitations apply to Model Aircraft which are not operated in accordance with an FAA accepted set of standards, but are operated by hobbyists for the sole purpose of sport, recreation, and/or competition.

ALTERNATIVE VIEW: Eliminate Section 3.0 in its entirety.

ALTERNATIVE RATIONALE: AMA believes this approach is flawed in that it fails to recognize the substantial diversity of the hobby, establishes unrealistic and unenforceable restrictions, and leaves absent a safety surveillance program to oversee the activities of those modelers who choose not to participate in a formal aeromodeling structure/organization More importantly, as a baseline set of standards, these limitations have the inherent potential of imposing a devastating impact on the aeromodeling activity and the hobby industry.

3.2 General Requirements ●

(1) Model Aircraft shall be flown in open spaces and in a manner that does not endanger the life and property of others.

(2) Model Aircraft shall yield the right of way to all manned aircraft.

(3) Model Aircraft shall not interfere with operations and traffic patterns at airports, heliports, and seaplane bases.

(4) Model Aircraft shall not be operated at locations where Model Aircraft activities are prohibited.

(5) Model Aircraft are limited to unaided visual line-of-sight operations. The Model Aircraft pilot must be able to see the aircraft throughout the entire flight well enough to maintain control, know its location, and watch the airspace it is operating in for other air traffic. Unaided visual line-of-sight does not preclude the use of prescribed corrective lenses.

(6) Model Aircraft shall be designed, equipped, maintained and/or operated in a manner in which the aircraft remains within the intended area of flight during all operations.

(7) Model Aircraft pilots may not intentionally drop any object from a Model Aircraft that creates a hazard to persons or property.

(8) Model Aircraft shall be operated in a manner that respects property rights and avoids the direct overflight of individuals, vessels, vehicles, or structures.

(9) Model Aircraft shall not be operated in a careless or reckless manner.

(10) Model Aircraft pilots shall not operate their aircraft while under the influence of alcohol or while using any drug that affects the person's faculties in any way contrary to safety.

(11) Model fixed-wing and rotorcraft aircraft shall not use metal-blade propellers.

(12) Model Aircraft shall not use gaseous boosts.

(13) Model Aircraft shall not use fuels containing tetranitronmethane or hydrazine.

(14) Model Aircraft shall not use turbine-powered engines (e.g., turbo-fan, turbo-jet) as a propulsion source. ●

RATIONALE: *Turbine powered aircraft are perceived by many members of the sUAS Aviation Rulemaking Committee (ARC) as being a higher risk.*

ALTERNATIVE VIEW: *Eliminate the limitation.*

ALTERNATIVE RATIONALE: *The blanket prohibition of turbine engines does not take into consideration the various and diverse turbine engines currently produced and impose an unjustified economic impact on the hobby industry.*

3.3 General Limitations ●

(1) Model Aircraft shall not exceed 55 pounds (lbs).

(2) Model Aircraft shall remain clear of clouds.

(3) Model Aircraft will not operate in Class B airspace without the permission of the ATC authority.

(4) Model Aircraft shall not be operated within 3 NM miles of an airport, heliport, or seaplane base without the permission of the ATC authority or airport manager.

(5) Model Aircraft shall operate in close proximity to the ground, at or below 400 feet (') above ground level (AGL), and shall at all times remain below and well clear of all manned aircraft. ●

RATIONALE: *By keeping Model Aircraft at or below 400' encounters with manned aircraft are reduced. This recommended general limitation is consistent with the current Model Aircraft guidance contained in AC91-57.*

ALTERNATIVE VIEW: Replace (5) with the following:

Model Aircraft shall operate in close proximity to the ground, shall stay at or below 400' AGL when within 3 NM of an airport, and shall at all times remain below and well clear of all manned aircraft.

ALTERNATIVE RATIONALE: *Though it is agreed that there needs to be some altitude limit on the modelers that are not participating in a structured safety program such as AMA's, AMA also knows from their experience that creating a hard and fast across the board altitude limit, such as 400' is unnecessarily restrictive, unrealistic, and arguably poses a greater risk to personnel on the ground. AMA's experience has shown that the greatest risk to other participants in the NAS and perhaps the only significant risk posed by model aviation is when Model Aircraft are operated within three miles of an airport. The language in the ATERNATIVE VIEW mirrors the current guidelines in the AMA Safety Code.*

(6) Notwithstanding the above limitations, Model Aircraft weighing less than or equal to two lbs incapable of reaching speeds greater than 60 miles per hour (mph) (52 knots), and powered by electric motor or mechanical stored energy (e.g.,

rubber-band powered) may operate within 3 NM of a military or public-use airport or heliport; if they remain a safe distance from the airport or heliport, remain well clear of all manned aircraft, and remain below 400' AGL.

RATIONALE for the above limitations:

(1) Currently accepted domestic weight limit and has international precedent as well.

(2) Is consistent with the concept of visual line-of-sight (VLOS).

(3) Class B is positive control. All aircraft are required to operate on a clearance. Gaining permission from ATC is equivalent to receiving a clearance.

(4) Model Aircraft permitted to operate within 3 NM of the airport will be provided applicable operating limitations.

(5) 400' is appropriate for Model Aircraft operations in Class C airspace without coordinating with ATC and is consistent with the intention of current domestic policy and with the UK, CASA, and Canada.

(6) This is consistent with the guidelines currently established by AC91-57.

(7) Makes a blanket exception for models weighing two lbs or less. This is an appropriate allowance for "Park Flier" and "toy" type models and allows them to use parks and small fields closer to airports.

(7) Model Aircraft will not be flown at an airspeed that would cause the aircraft to inadvertently leave the prescribed maneuvering area. ●

RATIONALE: *The pilot will be responsible for limiting their speed so that they can remain within the prescribed maneuvering area.*

ALTERNATIVE VIEW: Replace (7) with the following:

Model Aircraft cannot be operated at airspeeds which exceed 100 mph (87 knots).

ALTERNATIVE RATIONALE: *Restricting the speed of Model Aircraft not participating in an FAA-accepted safety program will mean that high-performance aircraft will not be operated by individuals that are not being scrutinized by their peers. Eliminating high-performance aircraft will also help to ensure that the operator will be able to keep their aircraft within the defined operational area (line-of-sight and below 400' AGL). Limiting the speed also will reduce the likelihood of turbine powered aircraft being operated without the guidance of an FAA-accepted safety program. Turbine powered aircraft are perceived by many members of the ARC as being a higher risk.*

(8) Model Aircraft cannot launch pyrotechnic devices which explode or burn.

(9) Excluding take-off and landing, no powered Model Aircraft may be flown closer than 25 feet to any individual, except for the pilot and the pilots helper located at the flight line.

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Subpart B. Operating Rules

4. General Operating Limitations

The following general operating limitations determine the times, locations, and notification requirements for all sUAS operated under this regulation.

4.1 Daylight Operations

No person may operate a sUAS except between the hours of sunrise and sunset.

> ***RATIONALE:*** *Visual "see and avoid" is the primary mitigation for mid-air collisions.*

4.2 Visual Meteorological Conditions (VMC)

No person may operate a sUAS except in VMC with a minimal visibility of three miles.

> ***RATIONALE:*** *Visual "see and avoid" is the primary mitigation for mid-air collisions.*

4.3 Visual Line-of-Sight

No person may operate a sUAS unless they or another sUAS flight crew has sufficient unaided (corrective lenses exempted) visual contact with aircraft to be able to maintain operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating for other air traffic.

> ***RATIONALE:*** *Visual "see and avoid" is the primary mitigation for mid-air collisions.*

4.4 Safety of Those on the Surface ●

(1) No person may operate an sUAS in a manner that endangers the safety of persons and property on the surface.

(2) No person may operate a sUAS directly over an open air assembly of people. ●

> ***ALTERNATIVE VIEW: Add text –*** *"unless the sUAS is certified to have reliability and lack of lethality equal to any aircraft certified by the FAA for operation over an open air assembly of people."*
>
> ***ALTERNATIVE RATIONALE:*** *The applicant must have an opportunity to offer evidence that his sUAS can operate over open air assemblies without creating a hazard for people in that crowd. Public safety could be enhanced by the presence of sUAS in situations in which manned aircraft cannot operate without risk to people on the ground.*

(3) During an emergency, the safety of people on the surface must be given priority over the sUAS.

RATIONALE: *Makes it clear that the sUAS PIC is responsible for the safety of persons on surface (whether on the ground or on the surface in a vessel or vehicle).*

(4) In an in-flight emergency requiring immediate action, the PIC may deviate from any rule of this part to the extent required to meet that emergency.

RATIONALE: *Consistency with 14 CFR 91.3b.*

4.5 Notifications—Air Traffic Coordination

(1) UAS PIC must establish communications with the ATC and notify the airport manager if planning to operate within 10 NM of an airport with an operating control tower. sUAS PICs must comply with ATC instruction regarding operations.

(2) When operating within 3 NM of a military or public-use airport, heliport, or seaplane base without an operating control tower, sUAS PIC must notify the airport manager, if available.

(3) For all flights which are intended to operate greater than 400' AGL and are either: a) expected to exceed 30 minutes in duration or b) there is an expectation of one or more additional flights within a four hour period, the PIC will request the issuance of a Notice to Airmen (NOTAM) for the length of the operation as far in advance as feasible (recommend more than 24 hours, but less than 48 hours) by notifying the nearest ATC facility or Flight Service Station (FSS).

RATIONALE: *Makes the responsibility clear when the ATC or airport manager needs to be aware of sUAS operations. The ATC would be aware of all sUAS operations in Class C and D airspace or near towered-airports. ATC or FSS awareness would enable the ability to issue a NOTAM. All operations over 400' AGL would be eligible for a NOTAM as well.*

The group did not intend that the PIC would be required to have access to two-way ATC communications in Class C airspace unless ATC requires such access.

4.6 Operational Area

No person may operate a sUAS in the following areas:

(1) In a prohibited, restricted, or warning area without permission from the using or controlling agency, as appropriate.

(2) In a Flight Restricted Zone (FRZ) or Washington, DC Metropolitan Area Special Flight Rules Area (SFRA).

(3) On a published low altitude Military Training Routes (MTRs) without prior authorization from the controlling authority.

(4) In Class B Airspace.

RATIONALE: *Keeps sUAS from operating in areas where there are restrictions on civil operations. Also, keeps sUAS from operating in Class B airspace due to the complexity of these operations. Avoiding low altitude MTRs helps to reduce risk of collision between a low-flying fast-moving military aircraft and a sUAS.*

5. Operational Considerations Regarding Other Aircraft

5.1 Proximity to Other Aircraft

No person may operate a sUAS so close to manned aircraft as to create a collision hazard.

5.2 Requirement for a Qualified Visual Observer ●

The PIC must determine if a visual observer is necessary. A visual observer is necessary:

(1) If the sUAS is operated by a PIC either in a shelter or "headsdown", the operation requires the use of a qualified visual observer.

(2) For operations >400' AGL one dedicated qualified visual observer is required. ●

(3) If the PIC determines that a visual observer is necessary to maintain the safety of the operation.

RATIONALE: *Visual see and avoid is the primary mechanism of ensuring safe separation and avoiding collisions. These considerations make it clear when additional qualified visual observers are required. Given that there is more likely to be other aircraft above 500'AGL increasing the probability of a collision, an additional visual observer is added for sUAS operations over 400' AGL to aid in the ability to* ***see*** *and thus avoid other aircraft.*

ALTERNATIVE VIEW: *Require* ***two*** *dedicated qualified visual observers when operating above 400' AGL.*

ALTERNATIVE RATIONALE: *Given that there is more likely to be other aircraft above 500'AGL increasing the probability of a collision a minimum of two visual observers should be used.*

5.3 Visual Observer Duties

A qualified visual observer must scan the airspace around the sUAS for other aircraft which may be potential collision hazards.

(1) PIC or qualified visual observer (close proximity of PIC) must maintain position of the sUAS through direct visual observation in order to avoid creating a collision hazard with other aircraft, airborne hazards, persons on the ground, terrain, or obstructions.

(2) The qualified visual observer, if used, must maintain effective two-way communications with the PIC.

> ***RATIONALE:*** *Clearly defines visual observer duties as being focused on the "seeing" component of "see and avoid". Emphasizes that the visual observer is not necessarily focused on the sUAS but focused on scanning the airspace with awareness of the sUAS's location.*

(3) When using other aids to vision, such as binoculars, field glasses, or telephoto television, qualified visual observers must use caution to ensure that the unmanned aircraft remains within the approved visual limitation distance. Due to field of view and distortion issues, the use of such aids can be used to augment the qualified visual observer's visual capability, but cannot be used as the primary means of visual contact.

5.4 Right-of-Way Rules

sUAS must yield the right-of-way to all other aircraft. UAS flight crews must assume that other pilots cannot see their aircraft and therefore the burden of maneuvering for potential collision risk shall be on the sUAS PIC.

(1) The PIC must yield the right-of-way and when a manned aircraft is detected, always maneuver early to prevent a potential conflict. The preferred means of conflict avoidance is to descend and maneuver closer to the landing area and the PIC and/or qualified visual observer.

(2) Although sUAS should descend as its primary means of collision avoidance; the PIC should use the most appropriate maneuver for the situation.

(3) During an emergency, the safety of manned aircraft must be given priority over the sUAS.

(4) For sUAS encounters with other sUAS, the right-of-way rules defined in 14 CFR 91.113 apply, except that all sUAS must yield the right-of-way to manned aircraft.

> ***RATIONALE:*** *Most sUAS approximate the size of birds. Manned pilots expect birds to dive when encountering an aircraft, thus sUAS should behave similarly. Given that the PIC and/or observer on the surface may not always be able to accurately determine relative altitude or relative lateral bearing, it was felt by the consensus of the group that by descending as close to the surface as possible, the risk of collision could be reduced to the maximum extent. The working group also wanted to make it clear that the prime responsibility for maneuvering was on the sUAS PIC and that the safety of manned aviation had priority.*
>
> ***COMMENTARY:*** *It is not the intent of the ARC to limit the options available to the PIC, but to offer guidance as what is likely to be the most appropriate maneuver.*
>
> ***COMMENTARY:*** *These recommendations will need to be updated pending the development of recommendations focused on Lighter-Than-Air (LTA) sUAS.*

5.5 Communications Monitoring

When operating in Class C and D airspace, a sUAS PIC or qualified visual observer shall monitor ATC voice communications as instructed by ATC.

> ***COMMENTARY:*** *If the Control Station is equipped with ATC communications radio, the PIC and/or qualified visual observer* ***should*** *monitor ATC voice communications when operating in Class E or G airspace in the "Mode C veil" to identify aircraft that could potentially enter the airspace in which the sUAS is operating.*
>
> *If the Control Station is equipped with a UNICOM radio (Frequencies Used For Aeronautical Advisory Services To Private Aircraft) or Common Traffic Advisory Frequency (CTAF), the PIC and/or qualified visual observer* ***should*** *monitor to identify aircraft that could potentially enter the airspace in which the sUAS is operating.*
>
> ***RATIONALE:*** *For added situational awareness, it was felt that monitoring appropriate frequencies would aid the PIC and/or visual observers in being aware of other aircraft potentially in the airspace. While there may be some costs associated with the capabilities required, the consensus of the group was that the added safety value warranted the investment.*
>
> *Using the term "monitor" was deliberate. It was not the group's intent that the PIC or visual observer would be transmitting via 2-way ATC communications. This was for the following reasons:*
>
> - *It is unclear that a transmitter located on the surface several miles from the ATC radio antenna would be effective*
> - *We did not want to increase the workload of ATC controllers and increase ATC frequency congestion with chatter from sUAS operators. If controllers need to instruct all sUAS operators to cease operations due to an emergency in their sector, they can simply broadcast on the ATC channel which would be monitored by the sUAS operators*

6. General Operational Considerations

6.1 Take-off and Landing Area

(1) The PIC must ensure that sufficient space is available at the flying location to conduct safe take-off and landings.

(2) The PIC must ensure that the take-off and landing area(s) is clear of persons and property not associated with the operation to which the aircraft could pose a hazard.

> ***COMMENTARY:*** *It may be appropriate to establish a consensus standard on how a manufacturer should go about determining the minimum space required for take-off and landing.*

6.2 Control Station Operations ●

No person may operate a sUAS unless there is a one-to-one correspondence between Control Station and the unmanned aircraft. Control may be transferred from one Control Station to another provided procedures exist to affect the transfer including clear and immediate designation of the PIC at all times. The following is prohibited under this regulation:

(1) Using a Control Station to control more than one unmanned aircraft at a time.

(2) Simultaneously controlling an unmanned aircraft from more than one Control Station. **NOTE:** This does not apply to control of a payload or sensor package provided that operation of the sensor package or payload is electrically isolated from the sUAS flight control systems and operation has no significant effect on the flight parameters of the sUAS.

(3) A second Control Station cannot be used to increase operational range. ●

> ***ALTERNATIVE VIEW: Replace (3) with the following:***
>
> *A second Control Station may be used to increase operational range if all other provisions of this regulation are met.*
>
> ***ALTERNATIVE RATIONALE:*** *If each Control Station is equipped manned and operated like the initiating station with the required observer, communication capability and conforms with all required airspace restrictions minimal additional risks are introduced by transferring control and extending the operational range. It would be analogous to the aircraft landing at close to its maximum range and then taking off again under control of a second Control Station with overlapping coverage.*

6.3 Pilot-in-Command

With the exception of those aircraft operated in accordance with the provisions described in Section 9, no person may operate a civil sUAS under this regulation without a PIC who is certified to operate a sUAS consistent with the requirements in 15.

> ***RATIONALE:*** *Operators of Group I sUAS will not require certification.*

6.4 Pre-flight Procedures

The PIC is responsible for the following pre-flight procedures:

(1) **Familiarization:** The PIC must become familiar with the following information concerning the intended flight:

- Available weather reports and forecasts
- Fuel requirements
- Take-off and landing minimum space requirements
- Landing alternatives and emergency ditching locations
- Potential ground hazards
- Location of personnel directly involved with the operation

- Restrictions or limitations associated with the airspace in which operations will occur
- Local air traffic activity
- Location of persons and property on the surface
- Weight and Balance

(2) **Crew Verification:** The PIC must verify that all persons involved in the operation are trained and sufficiently knowledgeable and skilled in their operational responsibilities and that they meet the appropriate certifications, currency requirements, and medical qualifications for the intended flight.

(3) **Environment Assessment:** The PIC must assess the operating environment considering risks to people and property in the immediate vicinity both on the surface and in the air. This assessment must include weather conditions, local air traffic activity, the location of persons and property on the surface, and other ground hazards.

(4) **Pre-Flight Briefing:** The PIC must ensure that all sUAS flight crew members receive a pre-flight briefing on the operating conditions, emergency procedures, contingency procedures, roles and responsibilities, and potential hazards.

(5) **Aircraft and Equipment Inspections:** The PIC must ensure that the aircraft, Control Station, and other flight critical equipment are inspected for damage and are ready for flight per manufacturer guidelines.

(6) **Communications Check:** The PIC must ensure that the command, control, and communications link is working properly.

(7) **Weight and Balance:** The PIC must ensure that the weight is appropriately distributed in order to maintain the aircraft center of gravity to ensure stable flight in accordance with manufacturer recommendations.

6.5 Crew Fitness for Duty

The PIC must ensure that all crew members are rested and fit for intended duty. For flight operations, 10 hours of consecutive rest in the 24 hour period preceding the planned completion of his duty time. Non-local travel and other work duties associated with the employer are not considered part of the rest period.

> ***RATIONALE:*** *As with any commercial operation, crew duty day limits will help ensure that the flight crew is alert to maintain appropriate safety vigilance.*

6.6 Alcohol or Drugs

No person may act as a crewmember of a sUAS under the following conditions:

(1) Within eight hours after the consumption of any alcoholic beverage.

(2) While under the influence of alcohol.

(3) While using any drug that affects the person's faculties in any way contrary to safety.

(4) While having an alcohol concentration of 0.04 or greater in a blood or breath specimen. Alcohol concentration means grams of alcohol per deciliter of blood or grams of alcohol per 210 liters of breath.

> ***RATIONALE:*** *Consistent with operational regulations contained in 14 CFR 91.17.*

6.7 Dropping Objects

No PIC of a sUAS may allow any object to be dropped from that aircraft in flight unless reasonable precautions are taken to avoid injury or damage to persons or property.

> ***RATIONALE:*** *Consistent with operational regulations contained in 14 CFR 91.15.*

6.8 Careless and Reckless

No person may operate a sUAS in a careless or reckless manner so as to endanger the life or property of another.

> ***RATIONALE:*** *Consistent with operational regulations contained in 14 CFR 91.13.*

6.9 Reserves

The PIC must ensure that there is enough fuel and/or battery charge to fly for the intended time period and for no less than five minutes of reserved power.

> ***RATIONALE:*** *This requirement is loosely based upon 14 CFR 91.151, fuel requirements for flight in Visual Flight Rules (VFR) conditions. By having a reserve requirement, helps to ensure that the PIC does not run out of fuel/power during flight resulting in an uncontrolled aircraft. 91.151 requires 20 minutes VFR fuel reserves for rotorcraft. Given that sUAS will not be flying far from their landing areas, will remain relatively close to the surface, and have flight duration that may be extremely short, the requirement was modified five minutes. The main purpose of the reserve is to ensure that there is sufficient power for the aircraft to return from its farthest point and to ensure that it can remain aloft for a sufficient time period to ensure that the landing area is clear of hazards.*

6.10 Cloud Clearance ●

The sUAS PIC must ensure that the aircraft remains at least 500 feet below and 2000 feet horizontal from clouds in Class C, D, and E airspace and clear of clouds in Class G airspace.

> ***RATIONALE:*** *Enables the sUAS PIC and/or visual observer an opportunity to visually identify potential collision threats which may emerge from the clouds.*

*ALTERNATIVE VIEW: The sUAS PIC must ensure that the aircraft remains at least 500 feet below and 2000 feet horizontal from clouds in **all classes** of airspace.*

ALTERNATIVE RATIONALE: The 500 feet below and 2000 feet horizontal distances are consistent with the ultra-light requirements in 14 CFR 103.23 and parachute cloud clearance requirements in 14 CFR 105.17.

6.11 Operation from a Moving Vehicle ●

No person may control a sUAS from a moving vehicle or aircraft.

***RATIONALE:** Ensures that the area of sUAS operation is contained and controlled. Operation from a vessel on the water is allowed provided that this vessel is not moving. It is envisioned that those who desire to operate from a moving marine vessel in open water (e.g., Ocean or Great Lakes) could petition the FAA for a waiver from this provision.*

***COMMENTARY:** The sense of the sUAS ARC was that operations in open ocean from a moving ship should not necessarily be a significant risk and should be enabled. Considerations should be made for existing air traffic density (e.g., Gulf of Mexico where there is significant rotorcraft operations associated with oil platforms).*

***ALTERNATIVE VIEW**: Eliminate restriction of operating from a moving vehicle.*

***ALTERNATIVE RATIONALE:** Military operators have found that operating a sUAS from a ground vehicle or vessel on the water is not significantly different than operating from a fixed location provided the PIC and/or visual observer is placed in a position in the vehicle or vessel where they have the same unobstructed view as they would if they were on the ground and "waypoint position relative" feature as discussed below is provided.*

"Waypoint position relative" feature rationale. Mobile operations are very different from stationary operations because navigation waypoints maintain a position relative to Earth, not the PIC at the ground station. A PIC at a control station will lose relative knowledge of position if the PIC and the control station move. Global Positioning System (GPS) reports absolute position but an interface can also be provided to calculate and report position relative to another position. Key waypoints for relative situational awareness do not move with the PIC and control station unless the particular system has some sort of "waypoint position relative" feature to manage this. The ground station also must have its own GPS or similar to keep track of its position in order to make relative aircraft position reports to the PIC and provide relative situation awareness such as range and bearing to the aircraft relative to PIC/ control station (situational

awareness during mobile operations are really difficult without this capability).

6.12 Airspeed

No person may operate a sUAS faster than an airspeed of 87 knots.

RATIONALE: *The AMA has determined that aircraft flying faster than 100 mph are considered a high performance aircraft. Faster aircraft are perceived as having greater risks.*

7. General Operational Capabilities

RATIONALE: *These operational capability and/or equipment provisions are analogous to the provisions contained in 14 CFR 91, subpart C, Equipment, Instrument, and Certificate Requirements.*

All sUAS operated under this regulation must have the following operational capabilities:

7.1 Command and Control Link

(1) The PIC must only operate a sUAS that employs appropriate technology to ensure reliability of communications control links and minimizes system vulnerability to radio frequency interference.

(2) When operating using 72-76 Megahertz (MHz) commonly used by the Model Aircraft community, the PIC must employ technology which ensures that there is no interference with Model Aircraft operations.

COMMENTARY: *Consensus standards will clearly define how to appropriately achieve the intended capabilities above. Thus, the defintion and specification of the appropriate technology will be left to consensus standards. The technology defined for 72-76 Mhz must ensure that the new transmission technology does not intefere with the legacy technology used by Model Aircraft today.*

7.2 Fly-away Protection

No person may operate a sUAS that does not employ a technical mechanism which automatically executes a strategy to retain the aircraft in the intended operational area in the event of the loss of control. The fly-away protection mechanism must return the sUAS safely to the surface, as soon as practical.

COMMENTARY: *Consensus standards will clearly define how to appropriately achieve the capabilities intended. Thus, the definition and specification of the appropriate technical mechanisms will be left to consensus standards.*

7.3 High Visibility

All sUAS operated under this regulation must be colored with a high-contrast scheme.

> ***RATIONALE:*** *Facilitates unmanned aircraft tracking by the PIC and visual observers as well as to increase the probability that it would be detected by pilots of manned aircraft.*
>
> ***COMMENTARY:*** *Consensus standards will clearly define how to appropriately achieve the capability intended. A single consensus standard could not only address coloring schemes for sUAS visibility, but also address the issue of identification markings (See Section 19.2). Thus, the sUAS ARC envisions a standard like "Standard Guide to the Visibility and Identification Markings of Small Unmanned Aircraft Systems for Commercial Use."*

7.4 Maneuverability ●

All sUAS must have the capability to descend 50 feet within five seconds of the PIC recognizing the need for an avoidance maneuver. Maneuver should be repeatable or the aircraft should return to the ground. ●

> ***RATIONALE:*** *Helps to ensure that the PIC can maneuver the sUAS to avoid potential conflicts and maneuver in the event of an imminent collisions threat. Capability could accommodate larger descents through repeat instruction or continued control surface deflection.*
>
> ***ALTERNATIVE VIEW:*** *To allow either a* ***climb*** *or descent of 50 feet within five seconds.*
>
> ***ALTERNATIVE RATIONALE:*** *Limiting an avoidance maneuver to only a descent may be impractical and could introduce risks. Circumstances may dictate that other options may be more appropriate. Having options may reduce risks.*

7.5 Position Reporting

If operating greater than 400' AGL all sUAS weighing over 4.4 lbs (2 kilograms (kgs)) must have the capability to display position and altitude information to the PIC.

> ***RATIONALE:*** *Helps the PIC maintain situational awareness and ensure that the aircraft remain within appropriate operating limits. If available, down-linked aircraft telemetry can be used by the PIC and/or qualified visual observers to aid in flight operation and visual acquisition.*
>
> ***COMMENTARY:*** *In the future, the FAA may want to consider having Automatic Dependent Surveillance-Broadcast (ADS-B) OUT either transmitting from on-board the aircraft or as a relay from the Control Station. This may assist manned aviation in the vicinity with situational awareness of the location of sUAS operations, especially as ADS-B IN utilization grows in the aviation community whom typically fly at low altitudes.*

8. Multiple Kinds of sUAS Operations

There are multiple kinds of operations for sUAS each with different operational limits and required operational capabilities determined by gross take-off weight, system robustness, and relative risk. The PIC is responsible for ensuring that operations are conducted consistent with these constraints. The five operating groups are summarized in the table below.

Group	Gross Take-Off Weight	Additional Operational Limits	Additional Required Operational Capabilities
I	≤ 4.4 lbs (2 kgs)	Section 9.2	Section 9.3
II	≤ 4.4 lbs (2 kgs)	Section 10.2	Section 10.3
III	≤ 19.8 lbs (9 kgs)	Section 11.2	Section 11.3
IV	≤ 55 lbs (25 kgs)	Section 12.2	Section 12.3
V	*LTA only*	Section 13 (Reserved)	Section 13 (Reserved)

9. Additional Provisions—Group I sUAS

Group I sUAS are very maneuverable, frangible, and slow moving aircraft which pose minimal risk to those on the surface and other aircraft.

9.1 Group I Physical Characteristics

The following physical characteristics apply to all Group I sUAS:

(1) Gross take-off weight equal to or less than 4.4 lbs (2 kgs) including fuel, batteries, and payload.

(2) Must not be capable of exceeding more than 30 knots calibrated airspeed at full power in level flight.

(3) Constructed in a frangible manner that would minimize injury to those on the surface and reduce damage to other aircraft in the event of a mid-air collision. A sUAS can be considered frangible if it is made of paper, wood, or breakable plastic and contains no substantial metal parts.

> ***RATIONALE:*** *A key differentiator between Group I and Group II sUAS is frangibility.*
>
> *Some alternatives discussed include the following:*
>
> - *Given that the word frangible means "breaks into pieces" the definition could focus on the nature of pieces such as the size of the largest hard piece or the frontal area of the largest piece*
> - *Ratio of plan view area to weight*
> - *Energy absorbing of the material*
>
> *With the "keep-it-simple" guidance in mind, the above definition is being proposed. The notion of frangibility is important in that the consequence*

of a collision between a sUAS and another aircraft or person/property on the surface is reduced if the sUAS itself is frangible.

COMMENTARY: *Consensus standards could be developed for how to construct a sUAS that would be considered frangible.*

9.2 Group I Additional Operational Limits ●

In addition to the limitations outlined in Sections 4, 5, and 6 of this regulation, a Group I sUAS must be operated:

(1) At or below 400' AGL in Class C, D, E, and G airspace.

RATIONALE: *Limiting Group I aircraft to at or below 400' mean that sUAS which are certified to a lower degree of robustness and operated by unlicensed PICs are less likely to encounter manned aircraft (since in the majority of airspace, manned aircraft must be at a minimum altitude of 500' or higher for fixed winged aircraft).*

(2) Within visual line-of-sight of the PIC and/or qualified visual observer or less than 1500' lateral distance from the location of the PIC and/or visual observer whichever is less.

(3) Greater than 3 NM of a military or public-use airport, heliport, or seaplane base.

RATIONALE: *Within 3 NM of an airport is the airspace where manned aircraft are likely to be operating close to the ground. To reduce encounters with unmanned aircraft which are certified to a lower degree of robustness and operated by unlicensed PICs, Group I aircraft are restricted from operating within 3 NM of an airport. The Group I sUAS is limited to specific operating areas.*

ALTERNATIVE VIEW: (Replace 9.2) with the following:

In addition to the limitations outlined in Sections 4, 5, and 6 of this regulation, a Group I small UAS must be operated:

(1) At or below 400' AGL in Class C, D, E, and G airspace.

(2) Within visual line-of-sight of the PIC and/or qualified visual observer or less than 1500' lateral distance from the location of the PIC and/or visual observer whichever is less.

(3) Greater than 3 NM of a charted public-use airport, heliport, or seaplane base unless the following requirements are met:

(a) The PIC, no less than one hour prior to beginning a flight, informs the controlling authority of all public use airports, heliports or seaplane bases within three miles of the area in which the flight will take place, the time and place of the flight operations, and inquires regarding any specific areas where sUAS flight shall be avoided.

(b) The PIC will initiate a call by cell phone to the nearest controlling authority to assure cell coverage and provide a call back number to facilitate contact of the PIC by the Controlling Authority if for any reason sUAS flight operations must suddenly be restricted or suspended.

(c) The sUAS shall operate no more than 200' higher than the maximum height of obstructions such as trees, power lines, structures, steep cliffs or bluffs within the flight area, or 400' AGL whichever is the lower altitude.

***ALTERNATIVE RATIONALE:** A distance of 3 miles from airport identified in this recommendation limits the commercial viability of sUAS employment for small business. It prohibits operation in the environment where nearly all the commercial opportunity exists. The mitigating factors in the alternate view establish definable and analyzable risk characteristics.*

9.3 Group I Additional Operational Capabilities ●

In addition to the operational capabilities outlined in Section 7 of this regulation the following capabilities are required:

(1) **Manual Flight Control:** Group I SUAS must be capable of only manual flight control, ensuring that PIC control inputs made in the Control Station are translated directly into corresponding control surface positions. ●

***RATIONALE:** The idea for Group I aircraft were that they are operated like a Model Aircraft for compensation and hire. Model Aircraft are not generally operated in any other manner than manual flight control. Such*

a system is likely to be less complex and thus easier for a non-license PIC to operate.

For operations requiring other than manual flight control (i.e., auto flight management) would thus have to be operated as Group II.

***ALTERNATIVE VIEW:** Group I sUAS should be allowed to utilize simple auto flight management systems as long as manual flight control can be assured.*

***ALTERNATIVE RATIONALE:** Technology has progressed to such a state that to preclude the use of simple auto flight management is unnecessarily restrictive. Consensus standards could be written to define such systems and the mechanisms to test and verify their performance.*

9.4 System Certification

The entire sUAS including airframe, communications link, and Control Station will be certified to standards outlined in Section 20.

***COMMENTARY:** The intent is that Group I sUAS will be certified to a lower level of robustness than other sUAS due to their relatively low perceived risk to people on the surface and other aircraft due to operational limits, frangibility requirements, short flight duration, stick-to-surface control, and low speed of operation. See Appendix B.*

10. Additional Provisions—Group II sUAS

Group II sUAS due to their small size, system robustness and maneuverability pose minimal risk to those on the surface and other aircraft.

10.1 Group II Physical Characteristics

The following physical characteristics apply to all Group II sUAS:

(1) Gross take-off weight equal to or less than 4.4 lbs (2 kgs) including fuel, batteries, and payload.

(2) Capable of less than 60 knots calibrated airspeed at full power in level flight.

(3) Cruise speed of less than 40 knots in level flight.

10.2 Group II Additional Operational Limits ●

In addition to the limitations outlined in Sections 4, 5, and 6 of this regulation, a Group II sUAS must be operated:

(1) At or below 400' AGL in Class C, D, E, and G airspace within 30 NM of an airport listed in Appendix D, Section 1 of 14 CFR Part 91 or within the lateral limits of Class B or Class C airspace area designated for an airport. ATC Notification is required per Section 4.5 for flights in Class C and D airspace or within 10 NM of an airport with an operating control tower or local airport advisory.

RATIONALE: *The operational area for Group II sUAS is similar for that of a Group I sUAS with the exception that a Group II can operate within 3 NM of a military or public-use airport, heliport, or seaplane base after coordination with ATC because the PIC is certified and the system has certified to a higher level of robustness.*

(2) At or below 700' AGL in Class G Airspace beyond 30 NM from an airport listed in Appendix D, Section 1 of 14 CFR Part 91 and not within the lateral limits of Class B or Class C airspace area designated for an airport (and operated consistent with the requirements in Sections 4.5 and 5.2).

RATIONALE: *Due to the added risk of operating above 400' AGL in Class G airspace, an additional visual observer and pilot notification via NOTAM is required. For all flights in Class C or D airspace or within 10 NM of an airport with a tower, ATC notification would enable a NOTAM to be issued as well.*

(3) Within the visual line-of-sight of the PIC and/or qualified visual observer or less than 1500' lateral distance from the location of the PIC and/or visual observer whichever is less. ●

ALTERNATIVE VIEW: *When position information is provided to the PIC, allow Group II sUAS flights to operate up to a lateral distance of ½ statute mile (sm) from the location of the PIC or qualified visual observer while still maintaining visual-line-of-sight.*

ALTERNATIVE RATIONALE: *Restricting Group II aircraft to visual line-of-sight or 1500' lateral distance from the PIC and/or qualified visual observer whichever is less is overly restrictive for systems capable of providing position information (bearing, range, and altitude) to the PIC. If this capability is provided the verification of the position of the aircraft is much easier than for a system that does not have this capability. Because this added capability ensures the PIC and/or qualified visual observer can quickly reacquire the aircraft after scanning the airspace for intruding aircraft it can be safely operated within visual line-of-sight of the PIC and/or qualified visual observer or less than ½ sm lateral distance from the location of the PIC and/or visual observer whichever is less.*

(4) If operating with 3 NM of a military or public-use airport, heliport, or seaplane base, the PIC must ensure coordination with ATC and/or the airport manager, if available.

10.3 Group II Additional Operational Capabilities

There are no additional operational capabilities required than those outlined in Section 7 of this regulation.

10.4 System Certification

The entire sUAS including airframe, communications link, and Control Station will be certified to standards outlined in Section 20.

> ***RATIONALE:*** *The intent is that all Group II sUAS will be fully certified and operated by fully certified flight crews.*

11. Additional Provisions—Group III sUAS

Group III sUAS are larger and thus pose a higher perceived risk than Groups I and II to those on the surface and their operations are restricted to sparsely populated regions.

11.1 Group III Physical Characteristics

(1) Gross take-off weight equal to or less than 19.8 lbs (9 kgs) including fuel, batteries, and payload.

> ***RATIONALE:*** *FAA-Department of Defense (DoD) Memorandum of Understanding for operation of sUAS involves a weight limit of 20 lbs.*

11.2 Group III Additional Operational Limits

In addition to the limitations outlined in Sections 4, 5, and 6 of this regulation, all Group III sUAS must be operated in the following manner:

(1) Not over populated places as depicted in "yellow" on sectional charts.

(2) At least 100 feet from any person, vessel, vehicle, or structure that is not associated with the operations.

(3) At or below 400' AGL in Class D, E, and G airspace within 30 NM of an airport listed in Appendix D, Section 1 of 14 CFR Section 91 or within the lateral limits of Class B or Class C airspace area designated for an airport. ATC Notification is required per Section 4.5 for flights in Class D airspace or within 10 NM of an airport with an operating control tower or local airport advisory.

> ***RATIONALE:*** *The operational area for Group III sUAS is similar for that of a Group II sUAS with the exception that, Group III sUAS cannot operate in Class C airspace.*

(4) At or below 700' AGL in Class G Airspace beyond 30 NM from an airport listed in Appendix D, Section 1 of 14 CFR Part 91 and not within the lateral limits of Class B or Class C airspace area designated for an airport (and operated consistent with the requirements in Sections 4.5 and 5.2).

> ***RATIONALE:*** *Due to the added risk of operating above 400' AGL in Class G airspace, an additional visual observer and pilot notification via NOTAM is required. For all flights in Class D airspace or within 10 NM of an airport with an operating tower, ATC notification would enable a NOTAM to be issued as well.*

(5) Within the visual line-of-sight of the PIC and/or qualified visual observer or less than ½ sm lateral distance from the location of the PIC and/or visual observer whichever is less.

(6) Greater than 3 NM of a military or public-use airport, heliport, or seaplane base.

(7) If operating beyond 1500 feet laterally from PIC, there must be at least one qualified visual observer in addition to the PIC.

11.3 Group III Additional Operational Capabilities

In addition to the operational capabilities outlined in Section 7 of this regulation the following capabilities are required for the operation of all Group III sUAS:

(1) **Position Reporting:** The sUAS must be capable of providing position and altitude data to the PIC.

> ***RATIONALE:*** *Knowing position and altitude information will assist the PIC in maintaining situational awareness and ability to adhere to operational limitations.*

(2) **Aviation Band Radio:** If operating within 5 NM of a non-towered airport, a qualified visual observer involved with the operation must monitor UNICOM or CTAF and announce sUAS activity on the frequency of the closest airport consistent with applicable procedures.

(3) **Electronic Position Reporting Capability:** All Group III sUAS operating beneath the floor of the lateral limits of Class C or B airspace, or within the Mode C veil, must be equipped and operate an electronic positioning reporting system consistent with 14 CFR 91.215 or acceptable to the Administrator.

> ***COMMENTARY:*** *The ARC feels that electronic position reporting is recommended if feasible for all Group III operations.*

11.4 System Certification

The entire sUAS including airframe, communications link, and Control Station will be certified to standards outlined in Section 20.

> ***RATIONALE:*** *The intent is that all Group III sUAS will be fully certified and operated by fully certified flight crews.*

12. Additional Provisions—Group IV sUAS

Group IV sUAS are the largest sUAS permitted to operate under this regulation. Because of their large size, their operation is restricted to extremely remote areas that pose minimal perceived risk to those on the surface.

12.1 Group IV Physical Characteristics

(1) Gross take-off weight equal to or less than 55 lbs (25 kgs) including fuel, batteries, and payload.

12.2 Group IV Additional Operational Limits ●

In addition to the limitations outlined in Sections 4, 5, and 6 of this regulation, a Group IV sUAS must be operated in the following manner:

(1) The PIC must obtain a Letter of Authorization (LOA) from the FAA verifying that the planned area of operation can be considered uninhabited and extremely remote.

> ***CRITERIA:*** *To be considered as uninhabited and extremely remote, the operational area must include all of the following characteristics:*
>
> - *Class G airspace*
> - *Outside of 30 NM of an airport listed in Appendix D, Section 1 of 14 CFR Part 91*
> - *At or below 700' AGL, must be at least 5 NM from a military or charted airport, heliport, or seaplane base* ●
> - *If operating above 700' AGL up to 1200' AGL, must be at least 10 NM from military or charted airport, heliport, or seaplane base*
> - *Not following published federal airways or MTRs (intent is not to prohibit sUAS from crossing airways or MTRs but to reduce encounters by minimizing exposure)*
> - *No occupied structures with the exception of structures inhabited by persons involved with the operation*
> - *Not over National Parks*
> - *Not under restricted areas or Military Operations Area (MOA)*
>
> *The FAA will need to determine the mechanism by which the FAA issues the LOA. The Operations Working Group envisions something like the local Flight Standards District Office (FSDO) applying the criteria above based upon an application from a potential operator. The criteria will be clearly communicated.*
>
> ***ALTERNATIVE VIEW:*** *Change above criteria to restrict operations to at least 10 NM from charted airport, heliport, or seaplane base.*

(2) The PIC must ensure that the Group IV sUAS is only operated in the area designated under the FAA LOA in (1) above.

(3) The PIC must not operate a Group IV sUAS within 100 feet from any person, vessel, vehicle, or structure that is not associated with the operations.

(4) The PIC must operate a Group IV sUAS at or below 1200' AGL.

(5) The PIC must ensure that the Group IV sUAS must remain within the visual line-of-sight of the PIC and/or qualified visual observer or less than 1sm lateral distance from the location of the PIC and/or visual observer whichever is less.

(6) There must be at least one qualified visual observer in addition to the PIC. If operating within 10 NM of a chartered airport, heliport, or seaplane base, two visual observers in addition to the PIC are required.

(7) If the sUAS is operated by a PIC either in a shelter or "headsdown", the operation requires the use of two qualified visual observers in addition to the PIC.

(8) The PIC must ensure that ATC is notified per Section 4.5.

12.3 Group IV Additional Operational Capabilities

> ***RATIONALE:*** *These operational capability and/or equipment provisions are analogous to the provisions contained in 14 CFR 91, subpart C, Equipment, Instrument, and Certificate Requirements.*

(1) **Position Reporting:** The sUAS must be capable of providing position and altitude data to the PIC.

> ***RATIONALE:*** *Knowing position and altitude information will assist the PIC in maintaining situational awareness and ability to adhere to operational limitations.*
>
> ***COMMENTARY:*** *The sUAS ARC discussed the potential value of Electronic Position Reporting Capability to enable manned aircraft that are appropriately equipped to maintain situation awareness of the sUAS operation. However, a concern was expressed that such equipment may not be available for sUAS and that the majority of manned aircraft likely to be operating in the vicinity may not be equipped. In the future, the FAA should consider requiring all Group IV sUAS to be equipped and operated with an electronic positioning reporting system consistent with 91.215 or acceptable to the Administrator (e.g., ADS-B).*

12.4 System Certification

The entire sUAS including airframe, communications link, and Control Station will be certified to standards outlined in Section 20.

> ***RATIONALE:*** *The intent is that all Group IV sUAS will be fully certified and operated by fully certified flight crews.*

13. RESERVED: Additional Provisions—Group V Lighter-than-Air sUAS ●

> ***COMMENTARY:*** *The sense of the sUAS ARC is that the FAA should address provisions for LTA unmanned aircraft. During the sUAS ARC deliberations, an attempt to develop additional provisions for these systems was made. Although the ARC consulted with subject-matter experts to develop these provisions, the ARC felt that the membership did not have the adequate expertise to make appropriate judgments to provide specific LTA recommendations to the FAA.*

14. Provisions Concerning sUAS Operations in Designated Testing Areas

A sUAS Testing Area is a location designated for the purpose of test flying sUAS. Consists of an uninhabited and extremely remote surface area including a safety buffer zone where surface access is controlled and thus is free of non-participants.

14.1 Groups of sUAS Allowed

The following Groups of sUAS are allowed to operate in Designated sUAS Testing Areas: Group I, II, III, and IV.

14.2 Additional Operational Limits for Operations in Designated sUAS Testing Areas

In addition to the limitations outlined in Sections 4, 5, and 6 of this regulation, a sUAS operated in a designated test area must be operated in the following manner:

(1) The area must be designated as an sUAS Testing Area via an FAA LOA.

CRITERIA: *To be considered as uninhabited and extremely remote area suitable for designation as a sUAS Testing Area, the operational area must include all of the following characteristics:*

- *Class G airspace*
- *Outside of 30 NM of an airport listed in Appendix D, Section 1 of 14 CFR Part 91*
- *Outside of the lateral footprint of Class B and Class C airspace*
- *Not over surface area containing populated places depicted as "yellow" on sectional charts*
- *Must be at least 5 NM from military or charted airport, heliport, or seaplane base unless operating at a private airport with the explicit permission of the airport authority*
- *If the intended designated test area is closer than 10 NM from a chartered or military airport, heliport, or seaplane base, there must be a public comment period to seek input from local users similar to the obstruction review process outlined in AC 70/7460-2K: "Proposed Construction or Alteration of Objects that May Affect the Navigable Airspace" (1 March 2000). This would involve public notice to be distributed to those agencies, organizations, or individuals with known aeronautical interests to determine if the proposal would be a hazard to air navigation. State and local aviation authorities, as well as various military organizations of the Department of Defense, are also offered the opportunity to comment on the aeronautical effects of the proposed sUAS test area*
- *The sUAS Operator must control surface access to physical footprint which includes the operational area and a buffer zone. The buffer*

zone shall extended from the perimeter of the operational area by at least ½ the greatest distance across the operational area. Thus, if the intended operational area is a circle with a radius of one mile, the physical footprint which includes the operational area and buffer zone would have a radius of two miles. The sUAS operator must ensure that there are no un-authorized people in the physical footprint

- *No occupied structures with the exception of structures inhabited by persons involved with the operation*

***NOTE:** Test Area should be NOTAM'ed as an "alert area" and appear on sectional charts including operational hours and appropriate point-of-contact. If the test area activity would continue beyond a six month period. [There is some concern that it may not be feasible to chart test areas on sectional charts due to issues associated with clutter.] Other aircraft are not prevented from accessing the alert area but do so with the full knowledge of potential sUAS activity in the area. Alert area and area of surface access control should exceed the operational area (area where sUAS is flown) by 100 percent, effectively creating a buffer zone.*

The FAA will need to determine the mechanism by which the FAA issues the LOA. The Operations Working Group envisions something like the local FSDO applying the criteria above based upon an application from a potential operator. The criteria will be clearly communicated.

(2) The PIC must ensure that the sUAS is only operated in the area designated under the FAA LOA in (1) above.

(3) At least 100 feet from any person, vessel, vehicle, or structure that is not associated with the operations.

(4) The sUAS must remain at or below 1200' AGL.

(5) The sUAS must remain within the visual line-of-sight of the PIC and/or qualified visual observer or less than 1sm lateral distance from the location of the PIC and/or visual observer whichever is less.

(6) There must be two qualified visual observers in addition to the PIC.

(7) The PIC must ensure that ATC is notified per Section 4.5.

14.3 Operational Capabilities

All sUAS operating in a designated sUAS testing area must have the operational capabilities identified in Section 7 of this regulation as well as the additional operational capabilities as defined in the table below.

Gross Take-Off Weight	Additional Required Operational Capabilities
0 lbs < and ≤ 4.4 lbs	Section 9.3 or Section 10.3
4.4 lbs < and ≤ 19.8 lbs	Section 11.3
19.8 lbs < and ≤ 55 lbs	Section 12.3
Lighter-than-Air	Section 13 (reserved)

14.4 System Certification

The PIC of sUAS operating in a designed sUAS testing area shall be responsible for assuring the sUAS is airworthy and ready for flight testing.

> ***COMMENTARY:*** *Consensus standards should be established which define the criteria for determing a system is ready for flight testing. The ARC envisions a basic check list to ensure safety of flight system components prior to first flight.*

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Subpart C. Personnel

15. Pilots

15.1 Applicability

This Section applies to all persons who seek to serve as PIC of sUASs. An approved training source as specified in this section can be one of the following:

(1) Certificated Instructor Pilot that meets the requirements of Section 17.

(2) Approved training program that meets the requirements of Section 18.

(3) PIC of an aircraft that has been flown under the provisions of Section 2.1, Section 14 or Section 23, or operating under a Certificate of Authorization (COA) or a Special Airworthiness Certificate

15.2 Certificate

Except as provided in Section 15.4, no person may act as PIC of a sUAS or in any capacity as a required pilot flight crewmember of a civil sUAS of the United States registry unless that person holds a valid pilot certificate issued under this recommendation in that persons possession or readily accessible when exercising the privileges of that pilot certificate.

15.3 Eligibility

To be eligible for a sUAS pilot certificate, a person must:

(1) Be at least 18 years of age.

(2) Be able to read, speak, write, and understand the English language.

(3) Complete an approved course of training on the aeronautical knowledge areas and on the areas of operation listed in this sub part.

(4) Pass the required knowledge test on the aeronautical knowledge areas listed in this sub part.

(5) Receive an endorsement from an approved training source.

RATIONALE: *Establishes eligibility requirements. The committee felt that establishing an age requirement of 18 was appropriate in that all manned aircraft commercial activity requires that minimum age.*

The committee also felt strongly that all sUAS pilots should complete sUAS specific written exam covering the knowledge areas specified as opposed to requiring completion of a Private Pilot written exam.

COMMENTARY: *The sUAS knowledge test should be the same for Groups I-IV.*

COMMENTARY: *The FAA should consider mechanisms to "grandfather" developers of sUAS and/or military personal who can present evidence of appropriate flight experience to a FSDO.*

15.4 Operations Not Requiring a Pilot Certificate

A person acting as PIC of a Group I aircraft as described in Section 9 does not require a pilot certificate. They must either pass a sUAS written knowledge test or complete an approved Group I sUAS training program which addresses the aeronautical knowledge areas listed in Section 15.5.

> ***COMMENTARY:*** *It is the intent of the sUAS ARC, that community-based organizations could establish and conduct the appropriate training program and associated testing for Group I sUAS student pilots.*

15.5 Aeronautical Knowledge Requirements

A person who applies for (a) a sUAS pilot certificate or (b) authorization to act as PIC of a sUAS satisfying the requirements in 15.4; must receive and log ground training from an authorized instructor or approved school and pass a knowledge test on the aeronautical knowledge areas listed below.

> ***COMMENTARY:*** *The FAA should develop an approach for giving credit to individuals that hold a current private, commercial, or airline transport pilot certificate or a person having passed the private pilot written.*
>
> ***RATIONALE:*** *The group felt that if sUAS of any size or performance characteristic was to be flown in the NAS for commercial purposes, the pilot should have demonstrated some level of knowledge appropriate to such operations. Again this is not intended to be a Private Pilot written exam. The committee expects that a knowledge test will be developed specifically for sUAS.*
>
> *These suggested knowledge areas are a watered down version of the knowledge areas required by Private Pilots. They have been established to reflect knowledge areas the group felt were appropriate to commercial operation of a sUAS.*
>
> *More specific details regarding these knowledge areas could be contained in a consensus standard to facilitate FAA approval of specific training programs.*

(1) Applicable regulations relating to sUAS pilot privileges, limitations, and flight operations.

(2) Incident/accident reporting requirements of the National Transportation Safety Board (NTSB) and FAA.

> ***RATIONALE:*** *Reporting of incidents/accidents are critical to the data gathering efforts.*

(3) Use of applicable portions of the aeronautical information manual and FAA advisory circulars.

(4) Use of aeronautical charts for VFR and Instrument Flight Rules (IFR) navigation, overlying airspace consideration, obstacle clearance requirements, and flight restrictions affecting sUAS operations.

RATIONALE: *Knowledge of aeronautical charts is essential for identifying airspace boundaries.*

(5) Recognition of critical weather situations from the surface that may affect safe sUAS operation. This would include procurement and use of aeronautical weather reports and forecasts.

RATIONALE: *General knowledge of hazardous weather will have a positive effect on accident/incident rates and reliability.*

(6) Safe and efficient operation of the sUAS including collision avoidance and recognition of hazardous in-flight situations.

RATIONALE: *To operate safely the PIC must understand collision avoidance procedures.*

(7) Effects of weather on sUAS performance.

RATIONALE: *Knowledge of temperature and altitude effects on sUAS performance is necessary for safe flight.*

(8) UAS configuration management including but not limited to weight and balance consideration or other factors affecting sUAS performance.

(9) Principles of aerodynamics, power plants, and aircraft systems appropriate to sUAS.

RATIONALE: *Fundamental understanding of aerodynamic principles and aircraft systems will contribute to reliability and better pilot performance.*

(10) Emergency procedures including recovery from unusual flight attitudes and recognition of stall/spins as applicable.

RATIONALE: *Stall/spin awareness and emergency procedures are an essential element to flight. Particularly to sUAS under direct pilot control.*

(11) Aeronautical decision making and risk management.

RATIONALE: *Decision making and risk assessment/management are essential elements in aviation.*

(12) Crew Resource Management.

RATIONALE: *Many sUAS operations will involve a PIC working with one or more visual observers.*

15.6 Flight Proficiency

A person who applies for an unmanned aircraft pilot certificate must have flown that aircraft under the provisions of Section 2.1, Section 14, Section 23, or under a COA or a Special Airworthiness Certificate, or must receive and log ground and flight training from an authorized instructor or approved school on the areas of operation listed below:

RATIONALE: *Establishes flight proficiency requirements for all system PICs regardless of aircraft size and performance. The committee left plenty of latitude for each operator/manufacturer to define how the training courses are constructed, left the number of training hours required out of the rule thereby allowing training to proficiency as determined by the school/instructor.*

These areas are modified extracts from 14 CFR Part 61 Private Pilot requirements. They have been tailored for sUAS operations and represent what the group felt were generic areas applicable to ALL platforms. The committee decided not to get overly specific due to the varied nature of the available systems and to provide ample latitude to instructors and schools to define training program's as they deem appropriate.

No reference to sensor package training requirements.

More specific details regarding flight proficiency could be contained in a consensus standard to facilitate FAA approval of specific training programs.

Flight proficiency requirements do not apply to perspective PICs of Group I sUAS.

(1) Preflight preparation.

(2) Preflight procedures.

(3) Range or operational area safety and risk assessment.

(4) Launches, recoveries, go-arounds, or wave-offs.

(5) Mission operations and management to include VFR navigation, adherence to prescribed flight plan, collision avoidance, and ATC communications.

(6) Flight and ground crew management as applicable.

(7) Emergency procedures as applicable to aircraft.

(8) Post-flight procedures.

15.7 Flight Review: Pilot-in-Command ●

(1) To operate a sUAS except if operated under Section 15.4, or Section 23, or under a COA or a Special Airworthiness Certificate, the PIC must complete a flight review administered by an authorized instructor or an approved school in the preceding 24 calendar months. ●

(2) The review must consist of a minimum of one hour of ground training including a review of current general operating rules for sUAS and applicable flight rules of 14 CFR 91 and; a minimum of one hour of flight training or of a duration equal to the operational limitation of the aircraft whichever is shorter and including at least one launch and recovery of the aircraft.

RATIONALE: The dynamic nature of the regulatory environment relating to sUAS operations in the NAS coupled with rapid technology changes makes it imperative that crews remain "current" and knowledgeable.

The flight review concept is an adaptation of the 14 CFR Part 61 requirements for manned aircraft. 14 CFR Part 61.56

ALTERNATIVE VIEW: Add a Recent Flight Experience Section, as follows: *(1) Except for flight training or to meet the proficiency requirements of this Part, no person may act as PIC of an unmanned aircraft unless that person has made a minimum of three successful flights including launch and recovery in the preceding 90 days. (2) For the purpose of meeting requirements of this part, the flights including launch and recovery can be accomplished in a training device approved by the Administrator.*

ALTERNATIVE RATIONALE: *Most segments of aviation require some form of PIC currency. There is concern that sUAS piloting skills will erode over time and thus increase risk. It is anticipated that the burden on the PIC would be minimal.*

15.8 Medical Certificate: Requirements and Duration

15.8.1 Operations Requiring a Medical Certificate ●

A person performing the duties of PIC of a sUAS shall:

(1) For all operations except those meeting the requirements of Section 15.4, possess at least a second class medical certificate with limitations for sUAS operations.

(2) As an alternative to (1) above, possess documentation from a licensed medical professional asserting that the individual has visual ability consistent with description contained in second class medical certificate requirements as defined in 14 CFR Part 67.203 and hearing consistent with the description contained in second class medical certificate requirements as define in 14 CFR 67.205.a.1. ●

(3) Have no physical limitation that would prevent carrying out the duties and responsibilities of an observer.

ALTERNATIVE VIEW: *Except as provided in Section 15.8.2 of this Part, a PIC must hold at least a second-class medical certificate with waivers as identified by designated medical examiner for sUAS operations as applicable.*

ALTERNATIVE RATIONALE: *Even an FAA medical certificate issued with limitations for sUAS privileges is more comprehensive than vision standards (i.e., reflexes, medical history, conditions, neurology, and pathology.)*

15.8.2 Operations Not Requiring a Medical Certificate

A person is not required to hold a medical certificate:

(1) When operating an aircraft that meets the requirements of 15.4 of this sub part.

(2) When acting as a sUAS instructor if that person is not acting as PIC.

(3) When taking a test for sUAS certification.

(4) When piloting a sUAS not as the PIC.

> ***RATIONALE:*** *It is the opinion of the sub group that medical certificates should be required of ALL sUAS PICs. However, under the "Group I" provisions and the realization that we are trying to afford opportunities to grow the light-weight side of the spectrum, the committee has agreed to waive the certification and medical requirements for Group I operations.*
>
> *The committee feels a second class medical was appropriate for all others in that these are operations for other than recreational purposes and the eyesight requirements for line-of-sight operations greater than 1500 feet away required a higher level of visual acuity.*
>
> *Driver's license eyesight requirements are too generous and inconsistent from state to state.*
>
> *(1) and (3) are consistent with manned aircraft operations.*

15.8.3 Duration of Medical Certificate ●

For sUAS operations under this sub part, a second-class medical certificate or medical examination expires at the end of the 36th month after the month of the date of the examination shown on the certificate. ●

> ***RATIONALE:*** *The group felt that extending the valid period for a second class medical for sUAS operations was appropriate given the nature of the operations and no passengers were involved.*
>
> *The third class medical duration is consistent with the newly released rules governing medical duration for pilots under 40 years of age. The committee thought this was appropriate for all sUAS observers regardless of age.*
>
> ***ALTERNATIVE VIEW:*** *The duration of the medical certificate should be consistent with the duration contained 14 CFR 61.23.*

15.9 Issuance of sUAS Certificate and Authorizations

An applicant for sUAS pilot certificate must comply with the requirements of Federal Aviation Regulations (FAR) Part 61.13 (a), (b). Additional requirements for sUAS group authorizations.

(1) Authorization to act as PIC of sUAS shall require instruction from an authorized instructor and demonstration of proficiency in all the flight proficiency areas of operation found in Section 15.5 of this sub part.

(2) Receive a logbook endorsement from an authorized instructor that the pilot has received the required instruction and been found competent to act as PIC of that style of aircraft.

RATIONALE: *This is general boiler plate establishing the requirement that states you must be a United States citizen or pay the necessary non citizen fee's to the government before a certificate can be issued.*

Requires that you apply for the certificate and be found competent to hold the certificate.

Clarifies the intent to permit operations of multiple aircraft types with a logbook endorsement.

16. Qualified Visual Observer

This Section applies to all persons who seek to serve in the capacity of a qualified visual observer per requirements outlined in Section 5.2.

16.1 Eligibility

To be eligible to perform the duties of visual observer for sUAS operations, a person must:

(1) Be at least 18 years of age.

(2) Be able to read, speak, write, and understand the English language.

(3) Been found competent by the PIC to serve in an observer capacity.

(4) Received training from a certificated sUAS pilot on the duties and responsibilities of an observer pertaining to the sUAS on which observer duty will be performed and on the aeronautical knowledge areas prescribed in Section 16.2 of this Subpart.

RATIONALE: *This Section delineates the requirements for observers as members of the sUAS flight crew. The committee does not advocate issuance of a certificate for this position, however we believe empowering the PIC with responsibility to train and "certify" an individual for observer duty is adequate.*

16.2 Aeronautical Knowledge Requirements

The PIC must ensure that any person serving as a qualified visual observer for sUAS operations has received instruction on the areas listed below:

(1) Regulations pertaining to operation of the sUAS.

(2) Use of aeronautical charts and FAA publications appropriate to the operation conducted.

(3) Determining ground or in flight visibility as appropriate and identification of hazardous weather conditions.

(4) Safe and efficient operation of the sUAS including collision avoidance and recognition of hazardous in flight conditions.

(5) Effective communication procedures including radio operations and direct, effective verbal communication with all sUAS flight crewmembers.

RATIONALE: *Because the qualified visual observer is essentially the "eyes and ears" of the PIC, the committee believes it appropriate that the visual observer be familiar with a sub set of the knowledge areas required of the pilot. The areas selected relate directly to the aircraft in flight and the environment in which it operates. The PIC retains full responsibility for the actions of the observer.*

16.3 Medical Requirements ●

A person performing the duties of visual observer when required by a sUAS shall:

(1) For operations meeting the requirements of Section 15.4, possess at least a third class medical certificate with limitations for sUAS operations.

(2) For all other operations, possess at least a second class medical certificate with limitations for sUAS operations.

(3) As an alternative to (1) and (2) above, possess documentation from a licensed medical professional asserting that the individual has visual ability consistent with description contained in second class medical certificate requirements as defined in 14 CFR Part 67.203 and hearing consistent with the description contained in second class medical certificate requirements as define in 14 CFR 67.205.a.1.

(4) Have no physical limitation that would prevent carrying out the duties and responsibilities of an observer.

RATIONALE: *Given that visual see and avoidance is a critical aspect of avoiding mid-air collisions and the visual observers primary function is to visually monitor the unmanned aircraft and the airspace around it for potential collision threats, it is critically important that their eyesight be professionally tested and verified. The recommended regulation makes it clear that either a third or second class medical certificate is required as appropriate or that there be some other form of documentation which indicates that the visual observer has the visual acuity consistent with the standards defined for a second class medical.*

COMMENTARY: *14 CFR Part 67.203 Contains the following visual standards for a second-class airman medical certificate:*

(1) Distant visual acuity of 20/20 or better in each eye separately, with or without corrective lenses. If corrective lenses (spectacles or contact lenses) are necessary for 20/20 vision, the person may be eligible only on the condition that corrective lenses are worn while exercising the privileges of an airman certificate.

(2) Near vision of 20/40 or better, Snellen equivalent, at 16 inches in each eye separately, with or without corrective lenses. If age 50 or older, near vision of 20/40 or better, Snellen equivalent, at both 16 inches and 32 inches in each eye separately, with or without corrective lenses.

(3) Ability to perceive those colors necessary for the safe performance of airman duties.

(4) Normal fields of vision.

(5) No acute or chronic pathological condition of either eye or adnexa that interferes with the proper function of an eye, that may reasonably be expected to progress to that degree, or that may reasonably be expected to be aggravated by flying.

(6) Bifoveal fixation and vergence-phoria relationship sufficient to prevent a break in fusion under conditions that may reasonably be expected to occur in performing airman duties. Tests for the factors named in this paragraph are not required except for persons found to have more than one prism diopter of hyperphoria, six prism diopters of esophoria, or six prism diopters of exophoria. If any of these values are exceeded, the Federal Air Surgeon may require the person to be examined by a qualified eye specialist to determine if there is bifoveal fixation and an adequate vergence-phoria relationship. However, if otherwise eligible, the person is issued a medical certificate pending the results of the examination.

COMMENTARY: *The existing "Guide for Aviation Medical Examiners Application Process for Medical Certification" could be used as testing criteria.*

ALTERNATIVE VIEW: *Accept a valid United States driver's license in lieu of a second-or third-class medical certificate.*

ALTERNATIVE RATIONALE: *In 14 CFR 61.303, a United States driver's license is accepted for the operation of light-sport aircraft.*

16.4 Duration of Medical Certificate ●

For sUAS operations under this sub part, a second-class medical certificate or medical examination expires at the end of the 36th month after the month of the date of the examination shown on the certificate. For operations requiring a 3rd class medical, the medical certificate expires at the end of the 60th month after the month of the date of the examination shown on the certificate. ●

RATIONALE: *The group felt that extending the valid period for a second class medical for sUAS operations was appropriate given the nature of the operations and no passengers were involved.*

The third class medical duration is consistent with the newly released rules governing medical duration for pilots under 40 years of age. The committee thought this was appropriate for all sUAS observers regardless of age.

ALTERNATIVE VIEW: *The duration of the medical certificate should be consistent with the duration contained 14 CFR 61.23.*

17. UAS Instructor

This Section prescribes the requirements for the issuance of sUAS instructor certificates, the conditions under which the certificate is necessary, and the limitations on the certificate.

17.1 Eligibility Requirements

To be eligible for a sUAS instructor certificate a person must:

(1) Be at least 18 years of age.

(2) Be able to read, speak, write, and understand the English language.

(3) Hold a sUAS pilot certificate.

(4) Pass a knowledge test on the aeronautical knowledge areas listed in 17.2 of this section unless the applicant:

- Holds a flight instructor certificate or ground instructor certificate issued under this part
- Holds a current teacher's certificate issued by a state, county, city, or municipality that authorizes the person to teach at an educational level of 7th grade or higher
- Is employed as teacher at an accredited college or university

> ***RATIONALE:*** *This recommendation is consistent with 14 CFR Part 61 instructor requirements for manned aircraft. 14 CFR Part 61.183. Provides for exemptions for an additional knowledge test.*
>
> ***COMMENTARY:*** *The FAA should consider mechanisms to "grandfather" developers of sUAS and/or military personal who can present evidence of appropriate flight experience to a FSDO.*

(5) Receive a logbook endorsement from an authorized instructor or aviation safety inspector on the areas of operation listed in Section 15.6.

(6) Logged at least 20 successful launch and recoveries with the sUAS to which instructor privileges are sought.

> ***RATIONALE:*** *The committee believes instructors need to have logged significant experience on a particular system. The committee wants to see consistent acceptable performance from the pilot, an ability to make good judgment calls, and know a system well enough to achieve a good track record of successful operations.*

17.2 Aeronautical Knowledge

Except as provided in Section 17.1 (4), a person who is applying for a sUAS instructor certificate must receive and log ground training from an authorized instructor on:

(1) The learning process.

(2) Elements of effective teaching.

(3) Student evaluation and testing.

(4) Course development.

(5) Lesson planning.

(6) Classroom training techniques.

17.3 Flight proficiency

17.3.1 Areas of Operation

A person who is applying for a sUAS instructor certificate must receive and log flight and ground training from an authorized instructor on the areas of operation listed below.

(1) Fundamentals of instructing.

(2) Technical subject areas.

(3) Preflight preparation.

(4) Preflight procedures.

(5) Range or operational area safety and risk management.

(6) Launches, recoveries, go-around's, or wave offs.

(7) Mission operations and management to include VFR navigation, adherence to prescribed flight plan, collision avoidance, and ATC communications.

(8) Flight and ground crew management as applicable.

(9) Emergency procedures as applicable to aircraft.

(10) Post-flight procedures.

> ***RATIONALE:*** *These areas are straight from 14 CFR Part 61. The FAA has a testing instrument in place which fits the bill for this part. Commercially available courseware is readily available to prepare an applicant for this test.*
>
> *This is an enhanced list of areas which include a requirement that the applicant demonstrate some teaching ability. All the areas are the same as those required for pilot certification.*

17.3.2 Endorsement

The applicant's logbook must contain an endorsement from an authorized instructor certifying the person is proficient in all the areas of operation and has been found qualified to hold a sUAS instructor certificate.

> ***RATIONALE:*** *This section provides for the certification of an instructor applicant with an endorsement by a qualified instructor. Again, like the sUAS Pilot Certificate, no additional practical test is required.*

17.4 sUAS Instructor Limitations and Qualifications

17.4.1 Hours of Training

In any 24 hour consecutive period, a sUAS instructor may not conduct more than 12 hours of instruction.

> ***RATIONALE:*** *As with manned aircraft instruction, the committee believes performance suffers when fatigue sets in. The committee felt it appropriate to limit instructor duty time to 12 hours per day. This is a longer duty day as compared to manned aircraft. 14 CFR Part 61.195 (a.)*

17.4.2 Aircraft Type Training

A sUAS instructor may not conduct instruction on a system for which the instructor does not hold a PIC endorsement.

> ***RATIONALE:*** *Fairly obvious that if you aren't qualified to fly a particular platform, you shouldn't instruct students on it.*

17.4.3 Limitations on Endorsements

A sUAS instructor may not endorse or recommend a student for a sUAS pilot certificate unless that instructor has given the instruction required by Section 15.5 of this subpart and/or found the student competent in all the prescribed knowledge and flight proficiency areas or; endorse a pilot's logbook for the flight review required by Section 15.6 of this subpart.

> ***RATIONALE:*** *The committee believes that it essential that an instructor take responsibility for a student from "cradle to grave". This rule mandates that before an endorsement is rendered, an instructor MUST provide the student with all the instruction or have the student demonstrate competency in the knowledge and skill areas. This is consistent with manned aircraft (14 CFR Part 61.195 (d)).*

17.4.4 Qualifications of the Instructor for Training First Time sUAS Instructor Applicants

The instruction provided to an initial applicant for a sUAS instructor certificate must be given by an authorized instructor who has held an instructor certificate for at least 12 months and has recommended at least three students for sUAS pilot certification.

> ***RATIONALE:*** *This rule is an attempt to insure that instructors who recommend other instructor applicants for a certificate have at least been performing the duties of an instructor for a reasonable amount of time. This is an attempt to insure quality and legitimacy to the instructor certification process. This is consistent with the requirements concept in 14 CFR Part 61.195 (h).*

18. sUAS Training Programs

This section describes the requirements for development and approval of training courses for sUAS pilots and instructors and the general operating rules for training programs and schools.

18.1 Requirements for Training Courses

An applicant for sUAS pilot training course approval must:

(1) Complete and submit application on a form prescribed by the administrator to the FAA FSDO having jurisdiction over the area where the training school is based.

> ***RATIONALE:*** *The committee is trying to capture the idea that community based organizations, operators and manufacturers have significant latitude in how to develop and administer training. This rule provides opportunity for individuals, organizations, or commercial training program developers to create sUAS training courses and deploy them. The work done by ASTM and others can certainly be leveraged. FAA will be responsible for "approving" the courses to make sure they comply with this sub part under guidance to be developed*

(2) For courses leading to a sUAS pilot certificate, submit a training course outline that includes:

- Lesson descriptions and content that covers all required knowledge and flight proficiency areas of operation found in 15.5 and 15.6 of this subpart
- A description of student evaluation criteria and all tests
- A description of the sUAS to be used in training
- For courses leading to a sUAS instructor certificate submit a training course outline that includes:
  - Lesson descriptions and content that covers all required knowledge and flight proficiency areas of operation found in 17.2 and 17.3 of this subpart
  - A description of student evaluation criteria and all tests

> ***RATIONALE:*** *This section identifies specific requirements all approved courses must contain prior to submittal. This is a subset of the requirements for training course outlines found in Part 141.*
>
> *This proposed rule provides opportunity for a school to hold authorizations to train on multiple platforms.*

18.2 Operating Rules and Limitations

This section describes the operating rules for approved sUAS training schools. An approved school includes any certified sUAS instructor or instructors who have submitted and received approval of a training course outline as prescribed in Section 18.1 of this subpart.

RATIONALE: *This section simply defines "approved school". An approved school could be a single instructor, community-based organization, university, sUAS manufacturer, or other appropriate entity. A school may be approved to train and qualify students for one or more Operating Group(s) of sUAS. Such approval shall involve progressive qualifications with Group I being the most basic and Group IV the most comprehensive.*

(3) No approved school may recommend an applicant for a sUAS pilot certificate or sUAS instructor certificate unless that student has completed the entire course of training and successfully passed all required examinations and tests.

(4) An approved school may train students on more than one sUAS.

(5) Training may be conducted in any suitable location at the discretion of the instructor but shall remain under the jurisdiction of the approving FAA FSDO.

RATIONALE: *This section puts some restrictions on schools and mandates that short-cuts are not allowed. Training to proficiency is permitted and encouraged but ALL the training must be completed prior to certification.*

Due to the nature of the business, it is conceivable that training could be offered in multiple locations by a single provider. This rule allows for this but the responsibility still lies with the approving FSDO.

Subpart D. Aircraft and Systems

19. Registration, Identification, and Marking

(1) All applicants for sUAS Certificates of Registration shall comply with Title 14, CFR, Part 47 unless that Part conflicts with this Subpart.

(2) sUAS registration shall be accomplished online via the FAA Aircraft Registry website. The aircraft is registered as of the date the online registration process is completed. A Certificate of sUAS Registration may be downloaded or printed following registration. The Certificate of Registration expires three years from the last day of the month in which the aircraft was registered. Renewal applications are accepted up to 90 days in advance of the expiration date of the current certificate. During flight operations the original or a copy of the Certificate of Registration will be located at the Control Station.

19.1 Registration Required

All civil sUAS shall be properly registered unless the aircraft is operated as defined in Subpart A.

19.2 Identification and Marking

All sUAS shall have its individual identification number on an identification plate and/or markings in accordance with the recognized consensus standards to ensure the identity of the aircraft can be determined following an incident or accident.

20. Initial Airworthiness Certification

COMMENTARY: *The General Aircraft provisions should account for mechanisms associated with certifying individual aircraft as well as aircraft production. Individual aircraft could be production models, kit built, or individual designs.*

Certification requirements should include the use of common language and consist of a program and regime that are applicable/attainable by small business (<5 persons).

If an aircraft is sold in kit form and/or the aircraft initial purchaser builds or assembles more than 51 percent of the aircraft, that individual shall be considered the first owner and the manufacturer.

20.1 Eligibility

For a civil sUAS to be eligible for a sUAS certificate

(1) An applicant must be able to provide the FAA upon request with the following:

- The system's operating instructions
- The system's maintenance and inspection procedures
- The manufacturer's statement of compliance with Section (3)

(2) The system must be inspected and found to be in a condition for safe operation by the applicant.

(3) The manufacturer must provide a statement of compliance which:

- Identifies the sUAS by make and model, serial number, date of manufacture, and any consensus standard used.
- State that the system meets the provisions of the identified consensus standard.
- State that the manufacturer will make available to any interested person the following documents that meet the identified consensus standard:
  - The system's operating instructions
  - The system's maintenance and inspection procedures

RATIONALE: *Following the Light Sport Aircraft approach, the sUAS ARC is recommending that details for certification be moved to consensus standards. The text above is modeled on the Light Sport Aircraft regulatory language contained in 21.190. The text above directs the use of consensus standards for declaring compliance for certification.*

Using the output from the System Certification Working Group and the thinking regarding system maturity from the Operations Working Group the ARC should include recommendations for consensus standards that follow the specifics outlined in Appendix B.

There may need to be Design and Construction standards for the following:

- *Aircraft (Fixed Wing, Lighter-than-Air, Rotorcraft, Power lift)*
- *Control Stations*
- *Command, Control, and Communications*
- *Launch and Recovery Systems*

In addition, consensus standards are needed to offer guidelines for test and evaluation including flight testing and production testing.

20.2 Initial Test and Evaluation

The person who registers the sUAS must ensure that equipment requirements and design provisions described in FAA accepted standards have been successfully tested.

> ***COMMENTARY:*** *Consensus standards will offer guidelines on appropriate processes and procedures for acceptance testing. See section 14.4.*

20.3 Production Approval

The production of multiple copies of a single sUAS for sale for commercial purposes shall follow production acceptance and quality assurance procedures as outlined in recognized consensus standards.

(1) For each system completed, the manufacturer shall state that he has complied with the production acceptance and quality assurance standards including:

- Ground and flight testing the aircraft
- Found the system performance acceptable
- Determined that the system is in a condition for safe operation

(2) The manufacturer will establish a monitoring program in order to identify and correct safety-of-flight issues.

> ***COMMENTARY:*** *The manufacturer should set up a monitoring program in accordance with established consensus standards.*

(3) On an annual basis, the manufacturer will report to the FAA relevant information regarding operational safety of their systems.

> ***COMMENTARY:*** *The FAA will need to define when and how and the content of such reporting.*

21. Continued Airworthiness

21.1 Inspection and Maintenance

The PIC will ensure that the sUAS has been inspected and maintained in accordance with manufacturer's procedures.

21.2 Record Keeping

The PIC is responsible for recording hours of operation, number of takeoffs/launches and landings/recoveries as well as mechanical discrepancies discovered during operation. The owner/operator is responsible for maintaining a log of repairs, alterations, and replacements.

21.3 Repairs and Modifications

Systems that are new, modified, suspected of damage, or that have undergone major maintenance or repair should be re-inspected in accordance with manufacturer's procedures.

> ***COMMENTARY:*** *The sUAS ARC recommends that consensus standards shall establish guidelines for manufacturer's inspection and maintenance procedures, record keeping, and repair and modification procedures.*

22. Reporting

22.1 Operational Safety Monitoring

The PIC will ensure that any equipment malfunctions are logged along with their effect on the operation and reported to the manufacturer in a timely fashion.

22.2 Annual Flight Hour Reporting

The certificate holder is responsible for reporting all flight hours on an annual basis to the FAA.

22.3 UAS Incident Reporting

COMMENTARY: *A definition of a reportable incident is needed. Some members of the ARC felt that that it is vital, in order to evaluate the sUAS safety case, that the FAA must list certain errors, failures and incidents that must be reported in short course such as typically done for flight interruption reports, flight reliability reporting etc. In addition, certain members of the ARC also felt that malfunctions such as failure of the aircraft to respond to flight commands from the control unit, failure of the flyaway protection system, failure of the lost link program, in-flight collision with another aircraft, structure, or person etc. should be reported immediately to FAA. It was also recommended by the ARC that the FAA should develop a sUAS safety program that would allow for data analysis that could enable safety-based data decisions to lead to future sUAS regulatory changes.*

Subpart E. Alternative Means of Compliance

23. Demonstration of Acceptable Level of Risk

Any sUAS may be operated in such a manner that the associated risk of harm to persons and property not participating in the operation is expected to be less than acceptable threshold value(s) as specified by the Administrator. Estimates of risk of harm shall be made according to recognized consensus standards acceptable to the Administrator. Aircraft operated in compliance with this provision need not comply with the provisions of Subpart B.

RATIONALE: *The intent of this recommendation is to enable non-model sUAS operations while bounding the associated risk of harm to manned aircraft, and to people and property on the surface. Accordingly, the regulations should exclude those operations which have excessive risk of harm, and permit those operations which have sufficiently low risk of harm—within the limits imposed by the FAA's overall terms of reference. To a much greater extent than for manned aircraft, this means that regulation must allow reliability and hazard-mitigation measures to vary from mission to mission, with the required reliability and mitigation increasing with density of traffic and population. A "risk-based" means of compliance provides the necessary flexibility, allowing designers and operators to deploy technology and procedures as appropriate to their intended applications.*

The committee considered the alternative of a waiver process for designs and applications not covered by the "bins and boxes" of other subparts. The waiver process has the disadvantages of relatively high cost to the FAA, lack of standardization, and uncertainty of outcome for designers and operators. An affirmative compliance path instead offers standardization, transparency, and predictability, which is essential for encouraging new investment and applications.

This subpart invites industry, academia, and government to apply analysis and experience to establishment of practical standards for risk estimation, which the FAA can choose to accept or reject. Any accepted standard(s) can effectively be made part of the regulations by Notice of Acceptability. Such action would enable use of this subpart. Implementation would involve relatively low cost for the FAA, liability would fall under the blanket of the standard, and modifications can be made as indicated by experience.

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Appendix A: Summary Matrix

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Physical Characteristics						
Max Weight	4.4 lbs (2 kgs)	4.4 lbs (2 kgs)	19.8 lbs (9 kgs)	55 lbs (25 kgs)	Reserved	
Frangibility	Required	Not Required	Not Required	Not Required		
Max speed	< 30 knots cruise	<60 knots calibrated @ full power; <40 knots cruise	87 knots	87 knots		
Manual Flight Control	✓	✓	✓	✓		
Auto Flight Management	×	✓	✓	✓		
Operational Area						
Class A	n/a	n/a	n/a	n/a		
Class B	×	×	×	×		×
Class C	≤400' AGL	≤400' AGL	×	×		×
Class D	≤400' AGL	≤400' AGL	≤400' AGL	×		×
Class E	≤400' AGL	≤400' AGL	≤400' AGL	×		×
Class G (Mode c veil)	≤400' AGL	≤400' AGL	≤400' AGL	×		×
Class G (outside Mode c)	≤400' AGL	≤700' AGL	≤700' AGL	≤700' AGL if <10 NM of military or charted airport, heliport, or seaplane ≤1200' AGL if ≥ 5 NM of military or charted airport, heliport, or seaplane		≤1200' AGL

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Proximity to airports	> 3 NM from a military or public-use airports, heliports, and seaplane bases	< 3 NM from a military or public-use airports, heliports, and seaplane bases requires ATC notification	> 3 NM from a military or public-use airports, heliports, and seaplane bases	> 10 NM for ops up to 1200'AGL > 5nm for ops up to 700' AGL		>5 NM (<10nm requires public comment)
Prohibited, restricted, or warning area	Permission required	Permission required	Permission required	Permission required		Permission required
Flight restricted zone	×	×	×	×		×
Military Training Route	Permission required	Permission required	Permission required	Permission required		Permission required
Population Density						
Directly over open air crowds	×	×	×	×		×
< 100 feet from persons, vessels, vehicles, or structures	✓	✓	×	×		×
Populated Places (yellow on sections)	✓	✓	×	×		×
Occupied Structures	✓	✓	✓	×		×
Conditions						
Daylight	✓	✓	✓	✓		✓
VMC (with > 3 miles visibility)	✓	✓	✓	✓		✓
Cloud Clearance in Class C, D, and E airspace	500' below and 2000' horizontal	500' below and 2000' horizontal	500' below and 2000' horizontal	500' below and 2000' horizontal		500' below and 2000' horizontal
Cloud Clearance in Class G Airspace	Clear of Clouds	Clear of Clouds	Clear of Clouds	Clear of Clouds		Clear of Clouds

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Visual Line-of-Sight **VLOS or lateral max**	1500'	1500'	½ sm	1 sm		1 sm
Visual Observers **Min # required**	At the PIC's discretion	At the PIC's discretion	1 minimum if operating >1500' from the PIC	1 or 2 if operating < 10nm from a charted airport		2
> 400' AGL	n/a	Additional observer required 1 Minimum	Additional observer required 1 Minimum	Additional observer required 1 Minimum		Required
"Heads-down"	Minimum One Required	Minimum One Required	Minimum One Required	Required		Required
Equipment/ Capabilities **Position Reporting**	Not required	Required if operating > 400' AGL	Required	Required		
Anti-collision strobe	Not required	Not required	Not required	Not required		
UNICOM radio	Not required	Not required	Required if operating < 5 NM from a non-towered airport	Not required		
Electronic position reporting acceptable to the administrator	Not required	Not required	Required for operations in Class D or Class G airspace (within lateral limits of Class C/B, or in Mode C veil	Not required		

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Mechanisms to reduce vulnerability of Command and Control Link (e.g., spread spectrum)	Required	Required	Required	Required		
Permitted Frequency Ranges **(* requires technical mechanism to ensure no interference with Model Aircraft operations)**	72-76 MHz* 902–928 MHz 2400–2500 MHz	72-76 MHz* 902–928 MHz 2400–2500 MHz	72-76 MHz* 902–928 MHz 2400–2500 MHz	72-76 MHz* 902–928 MHz 2400–2500 MHz		
Fly-away Protection	Required	Required	Required	Required		
High-visibility	Required	Required	Required	Required		
Maneuverability	50' in 5 secs	50' in 5 secs	50' in 5 secs	50' in 5 secs		
Communications Monitoring						
Should Monitor	ATC: If Control Station equipped and operating in Class E or G airspace in Mode c veil UNICOM: If Control station equipped	ATC: If Control Station equipped and operating in Class E or G airspace in Mode c veil UNICOM: If Control station equipped	ATC: If Control Station equipped and operating in Class E or G airspace in Mode c veil UNICOM: If Control station equipped	ATC: If Control Station equipped and operating in Class E or G airspace in Mode c veil UNICOM: If Control station equipped		ATC: If Control Station equipped and operating in Class E or G airspace in Mode c veil UNICOM: If Control station equipped

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Must Monitor	ATC: C or D airspace as instructed by ATC	ATC: C or D airspace as instructed by ATC	ATC: D airspace as instructed by ATC UNICOM: <5 NM from a non-towered airport	Not required		Not Required
Other operational requirements						
ATC Notifications	If operating < 10 NM from airport with control tower (Class C or D airspace)	If operating • < 10 NM from airport with control tower (Class C or D) • > 400' AGL for more than 30 mins or 2 or more ops in 4 hrs	If operating • < 10 NM from an airport with control tower (Class D) • >400' AGL for more than 30 mins or 2 or more ops in 4 hrs	If operating >400' AGL for more than 30 mins or 2 or more ops in 4 hrs		If operating >400' AGL for more than 30 mins or 2 or more ops in 4 hrs
Airport Managing Authority Notification	If operating < 3 NM from a military or public-use airport, heliport, or seaplane base without control tower	If operating < 3 NM from a military or public-use airport, heliport, or seaplane base without control tower	Not Required	Not Required		Not Required
NOTAM Routinely Issued	Per ATC	Per ATC and >400' AGL for more than 30 mins or 2 or more ops in 4 hrs	Per ATC and >400' AGL, in Class D, or <10 NM from airport with tower	Per ATC and >400' AGL for more than 30 mins or 2 or more ops in 4 hrs		Yes
Operational Area Charted on Sectional	n/a	n/a	n/a	n/a		Yes

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Pilot-in-Command						
UAS Pilot Certificate	Not required	Required	Required	Required		Required
Eligibility (18 years old; read, speak, understand English); approved course of training)	(complete approved training course)	Required	Required	Required		Required
UAS Knowledge Exam Passed	Required	Required	Required	Required		Required
Aircraft Specific Competency Endorsement	Required	Required	Required	Required		Not required if flight testing uncertified aircraft
Flight Review (Every 24 calendar months)	Not Required	Required	Required	Required		Required
Medical Certificate	Not required	Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos	Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos	Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos		Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos
Visual Observers						
UAS Pilot Certificate	Not required	Not required	Not required	Not required		Not required
Eligibility (18 years old; read, speak, understand English; received and logged training)	Required	Required	Required	Required		Required

×: Not permitted ✓: Allowed	Group I	Group II	Group III	Group IV	Group V LTA	Test Center
Medical Certificate	Required Class III every 60 mos -or- Visual /hearing exam consistent with Class II every 36 mos	Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos	Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos	Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos		Required Class II every 36 mos -or- Visual /hearing exam consistent with Class II every 36 mos
UAS Instructor						
UAS Pilot Certificate	Required	Required	Required	Required		Required
Receive and log ground training on teaching fundamentals (unless holding a teaching certificate)	Required	Required	Required	Required		Required
Receive and log instruction on technical areas and flight proficiency	Required	Required	Required	Required		Required
Fundamentals of instruction knowledge test passed (unless holding a teaching certificate or CFI)	Required	Required	Required	Required		Required
Experience Requirement (20 L/R's in specific aircraft requesting teaching privileges)	Required	Required	Required	Required		Required
Medical Certificate	Not required unless acting as PIC or observer	Not required unless acting as PIC or observer	Not required unless acting as PIC or observer	Not required unless acting as PIC or observer		Not required unless acting as PIC or observer

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Appendix B: Summary of Recommendations for System Standards

Technical Requirements	Group I	Group II, III, and IV
Structural Integrity: The aircraft should be designed so that it maintains structural integrity for intended flight.	X	X
Adhering to Manufacturer's Specification: The system should be designed such that no component used in the system exceeds the manufacturer's maximum rating(s) for that component under normal operating conditions, if any.	X	X
Safe System Start-up: The system should be designed to initialize in a known, safe state upon power up.	X	X
Flight Control Cables: The aircraft should be designed such that flight control cables will not bind, jam, or chafe under all intended flight conditions.	X	X
Fire Protection: The system should be designed to minimize the likelihood of fire in the event of a crash.	X	X
Connectors: The aircraft should be designed such that control surface actuators, linkages, and control horns, if so equipped, and electrical connectors to flight critical components, if any, cannot disconnect due to normal or expected operations.	X	X
Control Station Synchronization: The system should provide a means to verify the Control Station software and the on-board systems are compatible and synchronized prior to flight.	X	X
Communications Range Test:		X
Operators Manuals: All sUAS must have an Operator's Manual that contains all of the information necessary for flight as identified in the recognized consensus standard. The Operator's Manual must be readily accessible to the PIC. The operator's manual should contain instructions, methods, and procedures to safely operate the system.		X

Technical Requirements	Group I	Group II, III, and IV
Maintenance and Inspection Procedures: All sUAS should have procedures for maintenance and inspection for the entire system to ensure continued airworthiness. The procedures should include applicable check lists for annual condition inspections and pre-flight inspection.		X
Component Failure Protection: The system should be designed such that in the event of any single component or system failure other than primary structure, the aircraft either remains controllable or a technical mechanism will automatically execute to ensure aircraft returns safely to the surface as soon as practical.		X
Powerplant Fail Safe: The aircraft should be designed such that a failure of the primary powerplant shall not result in the failure of primary flight control systems.		X
Fuel / Power Information: The system should provide a means of determining the amount of available on-board fuel or primary battery capacity for the primary propulsion unit and if equipped battery capacity for control power battery.		X
Fuel / Power Markings: The aircraft must have clear markings to indicate the type of fuel required (if any) and the polarity, type, and proper installation of batteries.		X
Prevention of Commands Which Exceed Structural Limits: The system should be designed to prevent control commands which would cause the aircraft to exceed structural limits of the airframe and control surfaces within the entire operating envelop.		X
Weight and Balance: The system should be designed to account for the weight and balance of intended payloads, fuel, batteries, etc., to ensure that the center of gravity is maintained in a manner that would enable stable flight.		X
Materials: The aircraft should be constructed of materials that will not break-up in flight when operated within the intended flight envelop.		X